An Assessment of Injury to Human Uses of Fishery Resources in the Grand Calumet River and Indiana Harbor Canal, the Grand Calumet River Lagoons, and Indiana Harbor and the Nearshore Areas of Lake Michigan

Volume I - Technical Report

Prepared for:

U.S. Fish and Wildlife Service
Bloomington Field Office
620 South Walker Street
Bloomington, Indiana 47403

Prepared – February 2003 – by:

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List of Acronyms

µg/kg	micrograms per kilogram
ABN	Acid-base neutrals
ARCS Program	Assessment and Remediation of Contaminated Sediments in the Great Lakes Program
ASTM	American Society for Testing and Materials
AVS	acid volatile sulfides
BSAF	biota-sediment bioaccumulation factor
BW	body weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq.)
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
cm	centimeters
COC	contaminant of concern
COPC	chemical of potential concern
CPG	Compliance Policy Guide
CSO	combined sewer overflow
DDTs	*p,p*'-DDT, *o,p*'-DDT, *p,p*'-DDE, *o,p*'-DDE, *p,p*'-DDD, *o,p*'-DDD, and any metabolite or degradation product
DO	dissolved oxygen
DuPont	E.I. du Pont de Nemours
EBGCR	East Branch of the Grand Calumet River
EBGCR-I	East Branch of the Grand Calumet River I
EBGCR-II	East Branch of the Grand Calumet River II
ESRI	Environmental Systems Research Institute, Inc. (ESRI's)
FCA	fish consumption advisory
FIELDS	Fully Integrated Environmental Location Decision Support
ft	feet
GCR/IHC	Grand Calumet River and the Indiana Harbor Canal
GCRL	Grand Calumet River Lagoons
GIS	geographic information system
gm	gram
HCH	hexachlorocyclohexane
HPV	health protection value
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IEC	Industrial Economics, Inc.
IH	Indiana Harbor
IHC	Indiana Harbor Canal
IH/LM	Indiana Harbor/Lake Michigan
ISBH	Indiana State Board of Health

ISDH	Indiana State Department of Health
K_{ow}	octanol-water partition coefficient
LGB	Lake George Branch
LM	Lake Michigan
MESL	MacDonald Environmental Sciences Ltd.
mg/kg	milligrams per kilogram
NC	not calculated
NG	no guideline
NH_3	unionized ammonia
NIPSCO	Northern Indiana Public Service Company
NPDES	National Pollutant Discharge Elimination System
NR	not reported
NRDA	Natural Resource Damage Assessment
NYSDEC	New York State Department of Environmental Conservation
OC	organic carbon
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDDs	polychlorinated dibenzo-*p*-dioxins
PCDFs	polychlorinated dibenzofurans
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
SEM	simultaneously extracted metal
SOD	sediment oxygen demand
SQC	sediment quality criteria
SQG	sediment quality guidelines
Sum DDD	*p,p*'-DDD + *o,p*'-DDD
Sum DDE	*p,p*'-DDE + *o,p*'-DDE
Sum DDT	*p,p*'-DDT + *o,p*'-DDT
SVOC	semi-volatile organic chemical
TCDD	tetrachlorodibenzo-*p*-dioxin
TDI	tolerable daily intake
TEQ	toxic equivalents
TOC	total organic carbon
Total DDT	*p,p*'-DDT, *o,p*'-DDT, *p,p*'-DDE, *o,p*'-DDE, *p,p*'-DDD, and *o,p*'-DDD
USACE	United States Army Corps of Engineers
USC	United States Canal
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
U.S. Steel	United States Steel (Division of USX Corporation)
VOC	volatile organic compound
WBGCR	West Branch of the Grand Calumet River
WBGCR-I	West Branch of the Grand Calumet River I

WBGCR-II	West Branch of the Grand Calumet River II
WQC	water quality criterion
WSDOH	Washington State Department of Health
WW	wet weight
WWTP	wastewater treatment plant

Glossary of Terms

Action level – The concentration of a substance in the edible portions of fish or shellfish at or above which USFDA will take legal action to remove products from the market.

Air resources – Those naturally occurring constituents of the atmosphere, including those gases essential for human, plant, and animal life.

Aquatic organisms – The species that utilize habitats within aquatic ecosystems (e.g., aquatic plants, invertebrates, fish, amphibians and reptiles).

Aquatic ecosystem – All the living and nonliving material interacting within an aquatic system (e.g., pond, lake, river, ocean).

Aquatic food web – The feeding relationships by which energy and nutrients are transferred from one species to another.

Assessment Area – The areas within which natural resources have been affected directly or indirectly by the discharge of oil or release of a hazardous substance and that serves as the geographic basis for the injury assessment in this report.

Beneficial uses – In the context of the Great Lakes Water Quality Agreement, there are a number of beneficial uses of aquatic resources. Changes in the chemical, physical, and/or biological integrity of the Great Lakes system have resulted in the impairment of 14 beneficial uses in the Indiana Harbor Area of Concern. In this report, restrictions on the consumption of fish and wildlife are of primary interest relative to the assessment of injury to human uses of fishery resources.

Benthic species – The organisms that live in, on, or near bottom sediments, including both epibenthic and infaunal species (see the definition for sediment-dwelling organisms).

Bioaccumulation – The net accumulation of a substance by an organism as a result of uptake from all environmental sources.

Bioaccumulation-based SQGs – Sediment quality guidelines (SQGs) that are established to protect fish and wildlife resources against effects that are associated with the bioaccumulation of contaminants in sediment-dwelling organisms and subsequent food web transfer.

Bioaccumulative substances – The chemicals that tend to accumulate in the tissues of aquatic organisms.

Biological resources – Those natural resources referred to in Section 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, nongame, and commercial species; and threatened, endangered, and State sensitive species. Other biota encompass shellfish, terrestrial and aquatic plants, and other living organisms not otherwise listed in this definition.

Biota-sediment bioaccumulation factor – The ratio of the concentration of a COPC in tissue to the level of the COPC in sediment, which may be determined from field studies or estimated using various modeling approaches.

Chemicals of Potential Concern – The COPCs are the substances that have the potential to cause injury to surface water or biological resources in the Assessment Area, including polychlorinated biphenyls (PCBs), oil and oil-related compounds (including alkanes, alkenes, naphthalenes, and polycyclic aromatic hydrocarbons; PAHs), metals, various pesticides, chlorinated benzenes, chlorophenols, phthalates, and polychlorinated dibenzo-*p*-dioxins / polychlorinated dibenzofurans (PCDDs/PCDFs).

Chemical benchmark – Guidelines for water or sediment quality which define the concentration of contaminants that are associated with high or low probabilities of observing harmful biological effects, depending on the narrative intent.

Contaminants of concern – Those substances that occur in sediments and/or fish tissues at concentrations that are sufficient to cause or substantially contribute to injury to human uses of fishery resources.

Contaminated sediment – Sediment that contains chemical substances at concentrations that could harm sediment-dwelling organisms, wildlife, or human health.

Conventional variables – A number of variables that are commonly measured in water and/or sediment quality assessments, including water hardness, DO, conductivity, total organic carbon (TOC), sediment oxygen demand (SOD), unionized ammonia (NH_3), temperature, dissolved oxygen (DO), pH, and alkalinity.

Discharge – Discharge of oil as defined in Section 311(a)(2) o f the Clean Water Act, and includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil.

Ecosystem – All the living (e.g., plants, animals, and humans) and nonliving (rocks, sediments, soil, water, and air) material interacting within a specified location in time and space.

Ecological receptors – A plant or animal that may be exposed to a stressor.

Edible portions of fish – Includes skin-on fillets for scaled fish species and skinless fillets for scaleless fish species (e.g., catfish).

Environmental media – Components of the ecosystem with which ecological receptors and humans interact and, hence, be exposed to COPCs. In this report, the environmental media of greatest interest includes whole sediments and edible fish tissues.

Epibenthic species – The organisms that live on the surface of bottom sediments.

Exposure – Co-occurrence of or contact between a stressor (e.g., chemical substance) and an ecological component (e.g., aquatic organism).

Federal Project Area – Includes United States Canal (USC), Lake George Branch (LGB) from the Forks to Indianapolis Boulevard, and Indiana Harbor Canal (IHC) from the Forks to Columbus Drive.

Fish consumption advisory – A recommendation issued by an appropriate authority that is intended to provide human consumers of fish, other aquatic organisms, and wildlife with information regarding the benefits and risks associated with consumption.

Fishery resources – Those natural resources referred to in Section 101(16) of CERCLA as fish, shellfish, and other aquatic organisms. Fish include marine and freshwater aquatic species; game, nongame, and commercial species; and threatened, endangered, and State sensitive species.

General Population – Adult males and adult females who are not pregnant, breastfeeding, or who plan on having children.

Geologic resources – Those elements of the Earth's crust such as soils, sediments, rocks, and minerals that are not included in the definitions of surface water or ground water resources.

Grab (Dredge) samplers – A device that is used to collect surficial sediments (e.g., petite ponar dredge).

Ground water resources – Water in a saturated zone or stratum beneath the surface of land or water and the rocks or sediments through which ground water moves.

Hazardous substances – A hazardous substance as defined in Section 101(14) of CERCLA.

Infaunal organisms – The organisms that live in bottom sediments.

Injury – A measurable adverse change, either long or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance, or exposure to a product of reactions resulting from the discharge to oil or release of a hazardous substance. As used in this part, injury encompasses the phrases "injury", "destruction", and "loss". Injury definitions applicable to specific resources are provided in § 11.62 of this part.

Injury to human uses of fishery resources – An alteration in the chemical composition of fish or shellfish tissues that adversely affects the beneficial uses of these resources. Conditions sufficient to alter the chemical composition of fish or shellfish tissues were also considered to be indicative of injury to the human uses of fishery resources.

Natural resources – Land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the fishery conservation zone established by the Magnuson Fishery Conservation and Management Act of 1976), and State or local government, or any foreign government, any Indian tribe, or, if such resources are subject to a trust restriction on alienation, any member of an Indian tribe. These natural resources have been categorized into the following five groups: surface water resources, ground water resources, air resources, geologic resources, and biological resources.

Natural resource damage assessment – The process of collection, compiling, and analyzing information, statistics, or data through prescribed methodologies to determine damages for injuries to natural resources.

Oil – Oil as defined in Section 311(a)(1) of the Clean Water Act, of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil.

Piscivorus wildlife species – The wildlife species that consume fish as part or all of their diets (e.g., herons, kingfishers, otter, mink or osprey).

Population – An aggregate of the individuals of a species within a specified location in time and space.

Pore water – The water that occupies the spaces between sediment particles.

Release – A release of a hazardous substance as defined in Section 101(22) of CERCLA.

Sediment quality guideline – A chemical benchmark that is intended to define the concentration of a sediment-associated contaminant that is associated with a high or a low probability of observing harmful biological effects or unacceptable levels of bioaccumulation, depending on its purpose and narrative intent.

Sediment injury – The presence of conditions that have injured or are sufficient to injure sediment-dwelling organisms, fish, or wildlife.

Sediment – Particulate material that usually lies below water.

Sediment chemistry data – Information on the concentrations of chemical substances in bulk sediments or pore water.

Sediment-associated COPCs – COPCs that are present in sediments, including bulk sediments or pore water.

Sediment-dwelling organisms – The organisms that live in, on, or near bottom sediments, including both epibenthic and infaunal species (see the definition for benthic species).

Sensitive Population – Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

Surface Water Resources – The waters of the United States, including the sediments suspended in water or lying on the bank, bed, or shoreline, and sediments in or transported through coastal and marine areas. This term does not include ground water or water or sediments in ponds, lakes, or reservoirs designed for waste treatment under the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901-6987 or the Clean Water Act, and applicable regulations.

Threshold concentrations – Limits established by the Indiana State Department of Health (ISDH) to support the development of fish consumption advisories (FCAs).

Tissue-associated COPCs – COPCs that are present in tissues.

Tissue Residue Guideline – Chemical benchmark that is intended to define the concentration of a substance in the tissues of fish or invertebrates that will protect wildlife against effects that are associated with dietary exposure to hazardous substances.

Tolerance level – The concentration of a substance in the edible portions of fish or shellfish at or above which USFDA will take legal action to remove products from the market.

Trustee – Any Federal natural resources management agency designated in the National Contingency Plan and any State agency designated by the Governor of each State, pursuant to Section 107(f)(2)(B) of CERCLA, that may prosecute claims for damages under Section 107(f) or 111(b) of CERCLA; or an Indian tribe, that may commence an action under Section 126(d) of CERCLA.

Whole sediment – Sediment and associated pore water.

Wildlife – The fish, reptiles, amphibians, birds, and mammals that are associated with aquatic ecosystems (i.e., fish and wildlife resources).

Background Information Relevant to the Preparation of this Report

Professional Qualifications

The professional experience and educational qualifications which qualify Dr. Ingersoll and Mr. MacDonald to give the opinions that are included in this report are set out in their curricula vitae, which are included in Appendix 1.

Conflict of Interest

Dr. Ingersoll, Mr. MacDonald, and the other members of the study team do not have any personal interest in this report other than as paid consultants to the United States Fish and Wildlife Service. Our prior involvement with United States government sediment injury has been as paid consultants on specific projects related to hazard and environmental assessments. We have had no prior involvement with the potentially responsible parties in this assessment. The United States Geological Survey and MacDonald Environmental Sciences Ltd. will be paid the same regardless of the outcome of this case.

Documents Used to Prepare Report

In preparing this report, we have reviewed numerous texts, articles, protocols, and publications relating to the fate and effects of sediment-associated and tissue-associated chemicals of potential concern on ecological receptors and human health. A list of the documents that were considered during the preparation of this report is presented in the references cited section. In addition, we have relied on our knowledge of this river system, as acquired through a site reconnaissance (conducted in January, 1998) and previous investigations conducted within this Area of Concern.

Executive Summary

This investigation was conducted to determine if biological resources within the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, Indiana Harbor and the nearshore areas of Lake Michigan (i.e., the Assessment Area) have been injured due to discharges of oil or releases of other hazardous substances, as defined in 43 CFR § 11.62(f)(1)(ii) and (iii) in the United States Department of the Interior (USDOI) regulations for conducting natural resource damage assessments (NRDAs; CFR 2002). In this report, the term injury to human uses of fishery resources has been used to more specifically describe such injuries to biological resources. If the results of this assessment indicated that injury to human uses of fishery resources has occurred within the Assessment Area, then the subsequent objectives of this investigation were to identify contaminants of concern (COCs; i.e., those toxic or bioaccumulative substances that occur in sediments and/or fish tissues at concentrations that are sufficient to cause or substantially contribute to injury to human uses of fishery resources) in the Assessment Area and to evaluate the areal and temporal extent of injury to human uses of fishery resources.

In accordance with the Assessment Plan (Natural Resources Trustees 1997), this assessment of injury to human uses of fishery resources was focused on evaluating the effects on human use and/or consumption of fish that have occurred due to discharges of oil or releases of other hazardous substances. As defined in the assessment plan (Natural Resources Trustees 1997), the primary chemicals of potential concern (COPCs; i.e., the substances that could, potentially, be adversely affecting human uses of fishery resources) in the Assessment Area include polychlorinated biphenyls (PCBs), oil and oil-related compounds (including alkanes, alkenes, naphthalenes, and polycyclic aromatic hydrocarbons; PAHs), and metals (Natural Resources Trustees 1997). The other substances that were considered as COPCs in this investigation include various pesticides, chlorinated benzenes, chlorophenols, phthalates, and polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs). As many of these substances tend to become associated with sediments upon release into aquatic ecosystems, sediment contamination represents a concern with respect to the restoration of beneficial uses in the Assessment Area (IDEM 1991). Subsequent transfer of bioaccumulative substances to sediment-dwelling organisms and, ultimately, to fish and shellfish also has the potential to adversely affect beneficial uses within the Assessment Area, including the utilization of fishery resources by the public.

To facilitate this evaluation, the Assessment Area was initially divided into nine separate reaches, including the Grand Calumet River Lagoons (GCRL), East Branch Grand Calumet

River-I (EBGCR-I), East Branch Grand Calumet River-II (EBGCR-II), West Branch Grand Calumet River-I (WBGCR-I), West Branch Grand Calumet River-II (WBGCR-II), Indiana Harbor Canal (IHC), Lake George Branch (LGB), US Canal (USC) and Indiana Harbor/Lake Michigan (IH/LM; i.e., consistent with the approach used by MacDonald and Ingersoll 2000). In each of these reaches, the available sediment quality, tissue quality, and related information was collected, evaluated, and compiled. Subsequently, the data on seven of the nine reaches was consolidated to support the assessment of injury to human uses of fishery resources within the Grand Calumet River and Indiana Harbor Canal (GCR/IHC). Injury to human uses of fishery resources was also evaluated within the GCRL, and IH/LM. Division of the Assessment Area into these three areas facilitated implementation of a geographically consistent approach to the assessment of injury to human uses of fishery resources using all three of the indicators that were selected [i.e., sediment chemistry, tissue chemistry, and fish consumption advisories (FCAs); i.e., FCAs have been issued for these three geographic areas only].

An overview of the environmental issues and concerns in the Assessment Area, the study objectives, and the study approach are presented in Section 1 of this report. The geographic scope of the Assessment Area, the COPCs, and the natural resources contained within the Assessment Area are described in Section 2. More detailed narratives on the study approach and on the data sets that were used in this assessment are provided in Sections 3 and 4, respectively. Finally, the results of the assessment are presented in Section 5 of this report. A summary of these results is presented below to provide an overview of sediment quality, tissue quality, and related conditions within the Assessment Area, as they relate to injury of human uses of fishery resources.

Injury to Human Uses of Fishery Resources

An assessment of injury to human uses of fishery resources associated with discharges of oil or releases of other hazardous substances was conducted for the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, and Indiana Harbor and the nearshore areas of Lake Michigan. The definitions of injury to biological resources included in the USDOI regulations were generally applied to support this assessment of the effects of chemical contamination on human use and consumption of fish and shellfish [i.e., injury to human uses of fishery resources; 43 CFR § 11.62(f)(1)(ii and iii); CFR 2002]. That is, a total of three indicators were used to assess injury to human uses of fishery resources, including sediment chemistry, tissue chemistry, and FCAs.

In this report, injury to human uses of fishery resources was defined as the presence of conditions that have adversely affected or are sufficient to adversely affect the human use and/or consumption of fish. Accordingly, injury to the human uses of fishery resources is considered to be equivalent to injury to biological resources, as defined in the USDOI regulations for conducting NRDAs [43 CFR § 11.62(f)(1)(ii and iii); CFR 2002]. Injury to human uses of fishery resources was assessed for each of the areas defined above (i.e., the GCR/IHC, GCRL, and IH/LM). Three separate lines of evidence were used to determine if injury to human uses of fishery resources has occurred. More specifically, injury to human uses of fishery resources was considered to have occurred if the concentrations of one or more COPCs in two or more whole-sediment samples (separated by more than 100 feet) from an area exceeded the selected chemical benchmarks for the protection of human health. In addition, human uses of fishery resources were considered to have been injured if the concentrations of one or more COPCs in one or more fish tissue samples from an area exceeded the selected chemical benchmarks for the protection of human health [i.e., the tolerance levels or action levels that have been promulgated by the United States Food and Drug Administration (USFDA) **or** the Group 1 threshold levels that have been established by the Indiana State Department of Health (ISDH) to support the development of FCAs]. Furthermore, issuance of FCAs on one or more species of fish within an area was considered to provide the necessary and sufficient evidence of injury to human uses of fishery resources.

Grand Calumet River/Indiana Harbor Canal - Evaluation of the sediment chemistry data that were compiled in the project database indicate that sediments from the GCR/IHC have concentrations of numerous COPCs sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. There were exceedances of one or more of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of PAHs, PCBs, organochlorine pesticides, and/or other substances were measured (i.e., n=up to 244 for surficial samples and n=up to 127 for sub-surface samples). Therefore, it is concluded that concentrations of PAHs, PCBs, and/or other bioaccumulative substances occur in sediments from the GCR/IHC at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, and certain other chlorophenols, PAHs, and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Comparison of the available data on the levels of COPCs in the edible tissues of goldfish, white sucker, channel catfish, gizzard shad, sunfish, pumpkinseed, and carp from the GCR/IHC to the selected benchmarks for tissue chemistry indicates that mercury and PCBs frequently occurred at concentrations sufficient to injure human uses of fishery resources. Overall, 83% (70 of 87 samples) of the fish tissue samples collected from GCR/IHC had concentrations total PCBs that exceeded the tolerance levels that have been established by the USFDA. In addition, the Group 1 threshold concentrations of mercury and PCBs that were established by the ISDH were commonly exceeded in the edible tissues of fish from this portion of the Assessment Area (i.e., 6 of 86 samples for mercury and 87 of 87 samples for total PCBs). Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs have occurred at concentrations sufficient to injure human uses of fishery resources in the GCR/IHC. Organochlorine pesticides (i.e., chlordane) in the edible tissues of fish only rarely posed a potential risk to human health, based on comparisons to the USFDA action levels. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

In 1986, the Indiana State Board of Health (ISBH; which is now referred to as ISDH) advised the public to not eat any fish caught in the GCR/IHC due to the high levels of contamination in fish tissues. Since that time, FCAs have been explicitly issued in 12 additional years, including 1989 to 1994 and 1997 to 2002. As the 1986 and 1994 FCAs were not revoked by ISDH, it is reasonable to assume that these FCAs remained in effect during 1987 to 1988 and 1995 to 1996, respectively. Therefore, it is concluded that human uses of fishery resources in the GCR/IHC were injured during the period 1986 to 2002 as a result of the accumulation of mercury and PCBs in fish tissues.

Three lines of evidence, including information on sediment chemistry, tissue chemistry, and FCAs, were used to determine if injury to human uses of fishery resources has occurred within the GCR/IHC. All three lines of evidence indicate that human uses of fishery resources in the GCR/IHC have been injured, particularly due to the presence of mercury, PCBs, and/or chlordane in environmental media (i.e., whole sediments and edible fish tissues). Therefore, it is concluded that human uses of fishery resources in the GCR/IHC have been injured as a result of discharges of oil or releases of other hazardous substances.

Grand Calumet River Lagoons - Comparison of the measured levels of COPCs in whole sediment samples with the benchmarks for sediment chemistry indicate that a number of COPCs occur in GCRL sediments at concentrations sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. There were exceedances of one or more of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of PAHs, PCBs, and/or organochlorine pesticides were measured (i.e., n=up to 127 for surficial samples and n=up to 2 for sub-surface samples). Therefore, it is concluded that concentrations of PAHs, PCBs, and/or other bioaccumulative substances occur in sediments from the GCRL at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, chlorophenols, tetrachlorodibenzo-*p*-dioxin - toxic equivalents (TCDD-TEQs), and certain other PAHs and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Evaluation of available tissue chemistry data indicate that the levels of certain COPCs occurred in the edible tissues of carp, largemouth bass and/or bluegills at concentrations sufficient to injure human uses of fishery resources. While the USFDA action levels or tolerance levels were never exceeded in fish tissue samples collected from GCRL, the levels of mercury in 14% (i.e., 3 of 21 samples) and total PCBs in 100% (i.e., n=25) of the samples exceeded the Group 1 threshold levels that have been established by the ISDH. Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs have occurred at concentrations sufficient to injure human uses of fishery resources in the GCRL. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

FCAs have been issued for three species of fish from the GCRL. The FCAs on largemouth bass and carp have been effect from 1996 to 2002. In 1999, the ISDH also issued a FCA on bluegills. Therefore, it is concluded that human uses of fishery resources in the GCRL were injured during the period 1996 to 2002 as a result of the accumulation of PCBs in fish tissues.

Three lines of evidence, including information on sediment chemistry, tissue chemistry, and FCAs, were used to determine if injury to human uses of fishery resources has occurred within the GCRL. All three lines of evidence indicate that human uses of fishery resources in the GCRL have been injured, particularly due to the presence of mercury and PCBs in environmental media (i.e., whole sediments and edible fish tissues). Therefore, it is concluded that human uses of fishery resources in the GCRL have been injured as a result of discharges of oil or releases of other hazardous substances.

Indiana Harbor and the Nearshore Areas of Lake Michigan - Although fewer sediment chemistry data are available for IH/LM than are available for the other portions of the Assessment Area, evaluation of these data indicate that sediments from the IH/LM have conditions that are sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. There were exceedances of one or more of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of PAHs, PCBs, organochlorine pesticides and/or other bioaccumulative substances were measured (i.e., n=up to 30 for surficial samples). No data were available on the chemical composition of sub-surface sediments. Therefore, it is concluded that concentrations of PAHs, PCBs, and other bioaccumulative substances occur in IH/LM sediments at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, chlorophenols, and certain other PAHs and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

The available data on COPC concentrations in the edible fish tissues of brown trout, carp, gizzard shad, longnose sucker, sunfish, and yellow perch were compared to the selected benchmarks for tissue chemistry to determine if injury to human uses of fishery resources has occurred within IH/LM. The results of this evaluation indicate that the USFDA tolerance level for PCBs was exceeded in 18% (i.e., 4 of 22 samples) fish tissue samples from IH/LM. In addition, 19% (4 of 21 samples) and 86% (i.e., 19 of 22 samples) of the fish tissue samples from this portion of the Assessment Area had concentrations of mercury and total PCBs, respectively, that exceeded the Group 1 threshold levels that were established by the ISDH. Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs have occurred at concentrations sufficient to injure human uses of fishery resources in IH/LM. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

The first FCA for Lake Michigan was issued by the ISBH in 1977 to address concerns related to the accumulation of COPCs in lake trout. Between 1983 and 1989, the FCA was expanded to include various other fish species that were caught in the Lake Michigan sport fishery, including carp, catfish, brown trout, chinook salmon, coho salmon, and steelhead. The FCA that was issued in 1986 explicitly included all fish species caught in Indiana Harbor. Between 1990 and 2002, FCAs were issued each year to provide the public with guidance on the consumption of sport-caught fish from Lake Michigan and associated tributaries. In total, these FCAs restricted consumption of more than 30 species of fish that occur in Indiana Harbor and/or the nearshore areas of Lake Michigan during 1977, 1983, 1985 to 1987, and 1989 to 2002. As the 1977, 1983, and 1987 FCAs were not revoked by ISDH, it is reasonable to assume that these FCAs were also in effect during 1978 to 1982, 1984, and 1988. Therefore, it is concluded that human uses of fishery resources in Indiana Harbor and the nearshore areas of Lake Michigan were injured during the period 1977 to 2002 as a result of the accumulation of mercury, PCBs, chlordane, dieldrin, and/or DDTs in fish tissues.

Three lines of evidence, including information on sediment chemistry, tissue chemistry, and FCAs, were used to determine if injury to human uses of fishery resources has occurred within IH/LM. All three lines of evidence indicate that human uses of fishery resources in the IH/LM have been injured, particularly due to the presence of mercury, PCBs, chlordane, dieldrin, and DDTs in environmental media (i.e., whole sediments and edible fish tissues). Therefore, it is concluded that human uses of fishery resources in IH/LM have been injured as a result of discharges of oil or releases of other hazardous substances.

Contaminants of Concern

In this investigation, COCs were identified as those substances that occurred in whole sediments and/or edible fish tissues at concentrations that are sufficient to cause or substantially-contribute to injury to human uses of fishery resources. For each area, the sediment-associated COCs were identified as those substances that occurred in two or more whole-sediment samples at concentrations in excess of the corresponding chemical benchmark. Likewise, the tissue-associated COCs for an area included those substances that occurred in one or more fish tissue samples at concentrations in excess of the corresponding chemical benchmark (i.e., the tolerance levels or action levels that have been promulgated by the USFDA **or** the Group 1 threshold levels that have been established by ISDH to support the development of FCAs). Finally, the FCAs that have been issued for the GCR/IHC, for the GCRL, and for IH/LM were reviewed to determine which substance or substances were considered to be responsible for the risk to human health. A substance that was identified as a COPC and that was identified as either a tissue-associated COC or a substance that had driven one or more FCAs was designated as a principal COC. Substances that were identified as sediment-associated COCs, but for which there were no available tissue benchmarks or measured tissue chemistry (i.e., not identified as tissue-associated COCs) were not identified as principal COCs. The principal COCs are those substances that have been demonstrated to be associated with injury.

Grand Calumet River and Indiana Harbor Canal - The sediment-associated COCs in the GCR/IHC include benzene, benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, carbazole, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, beta-hexachlorocyclohexane, lindane, p,p’-DDD, p,p’-DDE, p,p’-DDT, and TCDD-TEQs.

Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. Comparison of the tissue chemistry data to the selected benchmarks for assessing hazards to human health associated with the consumption of fish tissues indicated that mercury, PCBs, and chlordane are the tissue-associated COCs in the GCR/IHC. Mercury and/or PCBs were identified as the substances responsible for the issuance of FCAs in the GCR/IHC between 1996 and 2002. Therefore, it is concluded that mercury and PCBs are the principal COCs in the GCR/IHC; additional benchmarks for tissue chemistry are needed to confirm that other COPCs (e.g., various PAHs, certain organochlorine pesticides, or TCDD-TEQs) occur in fish tissues at levels sufficient to injure human uses of fishery resources.

Grand Calumet River Lagoons - The sediment-associated COCs in the GCRL include benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1242, Arclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, chlordane, dieldrin, endrin, p,p'-DDD, p,p'-DDE, and p,p'-DDT. Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. In fish tissues, the substances that exceeded the USFDA action levels, the USFDA tolerance levels, or the ISDH Group 1 threshold levels included mercury and total PCBs. Based on the information provided in the Indiana FCA, PCBs were identified as the substances responsible for the issuance of FCAs in the GCRL between 1996 and 2002. Therefore, it is concluded that mercury and PCBs are the principal COCs in the GCRL; additional benchmarks for tissue chemistry are needed to confirm that other COPCs (e.g., various PAHs, certain organochlorine pesticides, or TCDD-TEQs) occur in fish tissues at levels sufficient to injure human uses of fishery resources.

Indiana Harbor and the Nearshore Areas of Lake Michigan - The sediment-associated COCs in IH/LM include benz[a]anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1242, total PCBs, and TCDD-TEQs. Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. Both mercury and PCBs were identified as tissue-associated COCs, based on exceedances of the USFDA action levels, USFDA tolerance levels, or ISDH Group 1 threshold levels. Based on the information provided in the Indiana FCA, PCBs, chlordane, dieldrin, and/or DDTs were the substances that were responsible for the issuance of FCAs in IH/LM between 1985 and 1990. In recent years (i.e., 1996 to 2002), PCBs and mercury were identified as the causative substances. Therefore, it is concluded that mercury, PCBs, chlordane, dieldrin, and DDTs are the principal COCs in IH/LM; additional benchmarks for tissue chemistry are needed to confirm that other COPCs (e.g., various PAHs, certain organochlorine pesticides, or TCDD-TEQs) occur in fish tissues at levels sufficient to injure human uses of fishery resources.

Spatial and Temporal Extent of Injury to Human Uses of Fishery Resources

In this investigation, the areal and temporal extent of injury to human uses of fishery resources was evaluated using the information in the Indiana FCAs. More specifically, the entire geographic area covered by a FCA was considered to have conditions sufficient to injure human uses of fishery resources during each year that a FCA was in effect.

Grand Calumet River and Indiana Harbor Canal - The FCAs that have been issued for the GCR/IHC generally apply to the West Branch of the Grand Calumet River (WBGCR), East Branch of the Grand Calumet River (EBGCR) downstream of the GCRL, and the IHC. However, the FCA that was issued in 1986 also included the LGB and Indiana Harbor. Based on the information evaluated, it is apparent that FCAs have been issued each year between 1986 and 2002, with the exception of 1987 and 1988. Although it was not explicitly stated by the ISBH, it is assumed that the FCA that was issued for the GCR/IHC remained in effect through 1987 and 1988. The FCAs for this portion of the Assessment Area recommended against consumption of any fish species taken from these waters. Therefore, it is concluded that the human uses of fishery resources in the GCR and IHC have been injured by discharges of oil or releases of other hazardous substances between 1986 and 2002, a period of 17 years. The human uses of fishery resources present in the LGB were injured during 1986, a period of one year.

Grand Calumet River Lagoons - The FCAs that have been issued for the GCRL apply to the East Lagoon, West Lagoon, Little West Pond, Little East Pond, and the Middle Lagoon. Based on the information provided in the Indiana FCA, it is apparent that FCAs have been issued for the GCRL each year between 1996 and 2002. During the period 1996 to 1998, these FCAs indicated that the consumption of largemouth bass and carp should be restricted or, in some cases avoided. The FCAs issued since 1999 also recommend that the consumption of bluegills from the GCRLs be restricted or avoided. Therefore, it is concluded that the human uses of fishery resources (in particular, the uses of bluegill, largemouth bass, and carp) in the GCRL have been injured by discharges of oil or releases of other hazardous substances between 1996 and 2002, a period of seven years.

Indiana Harbor and the Nearshore Areas of Lake Michigan - In this investigation, the FCAs that have been issued for Lake Michigan (or Lake Michigan and tributaries) were considered to apply to IH/LM. In total, these FCAs restricted consumption of more than 30 species of fish that occur in Indiana Harbor and/or the nearshore areas of Lake Michigan. Fish consumption advisories have been explicitly issued for IH/LM for a total of 19 years, including 1977, 1983, 1985 to 1987, and 1989 to 2002. As the FCAs that were issued in 1977, 1983, and 1987 were not revoked by ISDH, it is concluded that human uses of fishery resources in IH/LM have been injured by discharges of oil or releases of other hazardous substances between 1977 and 2002, a period of 26 years. Although there are numerous sources of COCs within the Lake Michigan basin, it is likely that the oil and other hazardous substances originating from Indiana Harbor (and elsewhere in the Assessment Area) contributed to the loadings of COCs in tissues of fish utilizing habitats within the nearshore areas of Lake Michigan.

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1.0 Introduction

The Grand Calumet River system is a relatively small drainage basin that flows through northwestern Indiana and northeastern Illinois (Figures 1, 2, and 3). The Grand Calumet River is comprised of two east-west oriented branches that meet at the southern end of the Indiana Harbor Canal (IHC; Natural Resources Trustees 1997). The East Branch of the Grand Calumet River (EBGCR) originates at the Grand Calumet River Lagoons (GCRL), just east of the United States Steel Division of USX Corporation (U.S. Steel) facility in Gary, Indiana. From the headwaters, the EBGCR flows in a westerly direction for about 10 miles to its confluence with the IHC and the West Branch of the Grand Calumet River (WBGCR; Brannon *et al.* 1989). The WBGCR extends some six miles from the IHC to the confluence with the Little Calumet River in northeastern Illinois. The WBGCR is atypical from a hydrological perspective in that the river usually flows in a westerly direction from Columbia Avenue to the confluence with the Little Calumet River (USACE 1995). However, the river can flow in either an easterly or westerly direction between Columbia Avenue and the IHC, depending on the water level in Lake Michigan (USACE 1995).

The Grand Calumet River system is connected to Lake Michigan by the IHC, US Canal (USC), and Indiana Harbor (IH; Figure 2). The IHC extends in a northerly direction from the confluence of the East and West branches of the Grand Calumet River to its junction with Lake George Branch (LGB) and USC (termed the Forks), a distance of approximately two miles. From the Forks, USC extends in a northeasterly direction for about two miles to IH. The LGB of the canal extends to the west from the Forks to the I-90 toll road (Natural Resources Trustees 1997).

Information from a number of sources indicates that the Grand Calumet River drainage basin is one of the most highly industrialized areas in the United States (Bright 1988; Brannon *et al.* 1989; Ryder 1993). Some of the industries that operate, or have operated, in the area include steel mills, foundries, chemical plants, packing plants, a distillery, a concrete/cement fabricator, oil refineries, and milling and machining companies (Ryder 1993). Permitted discharges from industrial operations, municipal wastewater treatment plants (WWTPs), and other sources contribute substantial quantities of wastewater to the river system. Non-point sources of chemicals of potential concern (COPCs) to the system include urban and industrial run-off, combined sewer overflows (CSOs), leachate or overflow from a number of wastefills or ponds, and spills of pollutants in and around industrial operations (Brannon *et al.* 1989). Releases of waste and wastewaters from these sources have resulted in the contamination of surface water, groundwater, sediment, and biota with a variety of toxic and bioaccumulative substances, including heavy metals, phenols, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, cyanide, and several other organic chemicals (Crane 1996; USGS 2000). Concerns associated with the widespread contamination of surface waters and sediments led to the International Joint Commission to designate the Grand Calumet River-Indiana Harbor complex as an Area of Concern under the Great Lakes Water Quality Agreement (IJC 1989).

To address concerns regarding historic discharges of oil or releases of other hazardous substances, the United States Fish and Wildlife Service (USFWS) and the State of Indiana (the trustees) are conducting a natural resource damage assessment (NRDA) of the Grand Calumet River, Indiana Harbor Ship Canal (including USC, IHC, and LGB), IH, and waters of nearshore Lake Michigan (Natural Resources Trustees 1997). As described in the assessment plan for the NRDA (Natural Resources Trustees 1997), the trustees are documenting the cumulative injuries resulting from exposure to multiple COPCs (i.e., due to discharges of oil or releases of other hazardous substances) and to determine the appropriate scope and scale of restoration and compensation (Natural Resources Trustees 1997). The primary COPCs in the Assessment Area (see Chapter 2 for a description of the geographic scope of the Assessment Area) are PCBs, oil and oil-related compounds (including alkanes, alkenes, naphthalenes, and PAHs), and metals (Natural Resources Trustees 1997). Other COPCs in the Assessment Area include various pesticides, chlorinated benzenes, chlorophenols, phthalates, and PCDDs/PCDFs. As many of the COPCs tend to become associated with sediments upon release into aquatic systems, sediment contamination represents a concern with respect to the restoration of beneficial water uses in this system (Ingersoll *et al.* 1997; MacDonald and Ingersoll 2000). As sediment-associated COPCs have the potential to adversely affect biological resources directly and to bioaccumulate in aquatic food webs, the presence of these substances in sediments poses hazards to a variety of ecological receptors and to human health.

1.2 Environmental Issues and Concerns in the Assessment Area

There has been a long history of industrial activities within the Grand Calumet River basin, with the land located north of the river being one of the most heavily industrialized areas in the United States (Natural Resources Trustees 1997). In response to concerns regarding environmental contamination and associated impairment of beneficial uses, the Indiana Department of Environmental Management (IDEM) and its partners developed a Stage One Remedial Action Plan for the IHC, the Grand Calumet River, and nearshore Lake Michigan in 1991 (IDEM 1991). As part of this effort, IDEM (1991) compiled information on potential sources of COPCs within the Area of Concern, which included:

- Four major permitted industrial point source dischargers [i.e., permitted under the National Pollutant Discharge Elimination System (NPDES), including U.S. Steel, E.I. du Pont de Nemours (DuPont), LTV Steel, and Inland Steel];
- 52 properties that were listed in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) as containing potentially uncontrolled hazardous wastes that require investigation;
- More than 400 facilities that were subject to regulation under the Resource Conservation and Recovery Act (RCRA), which means that they generate, transport, treat, store, or dispose of hazardous wastes; and,
- Three municipal WWTP (i.e., that are operated by the Hammond, Gary, and East Chicago Sanitary Districts).

In total, it was estimated that the Grand Calumet River and the IHC also received more than 11 billion gallons/year of untreated stormwater via 12 CSO outfalls (IDEM 1991). The locations of existing (as of October 2000) and historic outfalls within the Assessment Area are shown in Figure 4.

Discharges of oil or releases of other hazardous substances from both historic and ongoing sources have resulted in the release of a variety of toxic and/or bioaccumulative substances into receiving water systems within the Assessment Area. Some of the substances that have been released include TOC, nutrients, metals, oil and grease, phenolics, PAHs, phthalates, pesticides, and PCBs (Bright 1988; Polls *et al.* 1993; Hoke *et al.* 1993; Dorkin 1994; Ingersoll and MacDonald 1999). However, the trustees conducting this NRDA have agreed to primarily focus the assessment on natural resource injuries and damages which are associated with releases of PCBs, oil and oil-related compounds, and metals (Natural Resources Trustees 1997). Therefore, the primary COPCs in this assessment include PCBs, four classes of petroleum hydrocarbons (including alkanes, naphthalenes, aromatics, and alkenes), and various heavy metals (including aluminum, arsenic, beryllium, bismuth, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, strontium, thallium, tin, titanium, and zinc). For the purposes of this assessment, the list of primary COPCs has been expanded to included other bioaccumulative substances for which sediment and tissue benchmarks have been located and for which sediment and tissue residue chemistry exist [i.e., various pesticides, chlorinated benzenes, chlorophenols, phthalates, and tetrachlorodibenzo-*p*-dioxin - toxic equivalents (TCDD-TEQs)]. The subcategory of aromatic hydrocarbons includes a variety of PAHs, 16 of which are classified as priority pollutants by the United States Environmental Protection Agency (USEPA; Natural Resources Trustees 1997).

While some of the COPCs listed above remain in the water column, many others are known to accumulate in sediments (CCME 1999). The results of numerous sediment quality assessments conducted in recent years indicate that many of these substances occur at elevated concentrations in sediments within the Assessment Area (Floyd-Browne 1993; IDEM 1994; USEPA 1996a; 1996b; Tetra Tech EM Inc. 1998; Maxim Technologies 1999; Ingersoll and MacDonald 1999). The presence of elevated concentrations of COPCs in aquatic sediments represents an environmental concern because:

- Bed sediments provide essential and productive habitats for communities of sediment-dwelling organisms, including epibenthic and infaunal organisms. These organisms include such species as scuds (amphipods), mayflies (ephemeropterans), stoneflies (plecopterans), caddisflies (trichopterans), dragonflies and damselflies (odonatans), midges (dipterans), water fleas (cladocerans), worms (oligochaetes), snails (gastropods), and clams (bivalves);

- Sediment-dwelling organisms (including epibenthic and infaunal organisms) are important elements of freshwater ecosystems, representing important sources of food for many fish and other wildlife species;
- The presence of sediment-associated COPCs in freshwater ecosystems can adversely affect sediment-dwelling organisms and other components of the ecosystem;
- Certain sediment-associated COPCs can bioaccumulate in the tissues of aquatic organisms;
- The presence of elevated levels of COPCs in the tissues of fish and/or shellfish poses a potential hazard to piscivorus wildlife species;
- The presence of elevated levels of COPCs in the tissues of fish and/or shellfish poses a potential hazard to human health; and,
- The presence of elevated levels of COPCs in the tissues of fish and/or shellfish can result in the imposition of fish consumption advisories (FCAs) that restrict human uses of fishery resources.

1.3 Study Objectives

This investigation was conducted to determine if biological resources within the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, Indiana Harbor and the nearshore areas of Lake Michigan (i.e., the Assessment Area) have been injured due to discharges of oil or releases of other hazardous substances, as defined in 43 CFR § 11.62(f)(1)(ii and iii) in the United States Department of the Interior (USDOI) regulations for conducting NRDAs (CFR 2002). In this report, the term injury to human uses of fishery resources has been used to more specifically describe such injuries to biological resources. The USDOI regulations define a number of specific injury tests for different natural resources. These specific injury definitions (CFR 2002) include two different injury tests related to the effects of chemical contamination on human use and consumption of fish and shellfish (i.e., injury to human uses of fishery resources). According to these definitions, "injury to a biological resource has resulted from the ... release of a hazardous substance if the concentration of the substance is sufficient to ..."

- Exceed action or tolerance levels established under Section 402 of the Food, Drug, and Cosmetic Act, 21 U.S.C. 342, in edible portions of organisms [43 CFR § 11.62(f)(1)(ii)]; or,
- Exceed levels for which an appropriate State health agency has issued directives to limit or ban consumption of such organisms [43 CFR § 11.62(f)(1)(iii)].

This report, which was prepared collaboratively by MacDonald Environmental Sciences Ltd. (MESL), United States Geological Survey (USGS), and Industrial Economics, Inc. (IEC), is intended to support the NRDA by providing an assessment of injury to biological resources within the Assessment Area. More specifically, this report has been prepared to determine if human uses of fishery resources have been injured or are likely to have been injured due to discharges of oil or releases of other hazardous substances within the Assessment Area. If the results of this assessment indicate that injuries to human uses of fishery resources have occurred within the Assessment Area, then the secondary objectives of this report are to identify the contaminants of concern (COCs; i.e., those substances that are causing or substantially contributing to injury to human uses of fishery resources) and to evaluate the spatial and temporal extent of such injuries. Companion reports, ***An Assessment of Sediment Injury in the Grand Calumet River, Indiana Harbor Canal, Indiana Harbor, and the Nearshore Areas of Lake Michigan*** (MacDonald and Ingersoll 2000) and ***An Assessment of Sediment Injury in the West Branch of the Grand Calumet River*** (Ingersoll and MacDonald 1999) were prepared to assess injuries to surface water resources and other biological resources associated with sediment contamination within the Assessment Area.

1.4 Study Approach

To support completion of the overall project objectives, a number of specific project tasks were identified, including:

- Collect, evaluate, and compile information on the levels of COPCs in whole-sediment samples collected within the Assessment Area;
- Collect, evaluate, and compile information on the levels of COPCs in fish tissue samples collected within the Assessment Area;
- Collect, evaluate, and compile information on fish FCAs that have been issued for the Assessment Area;
- Identify chemical benchmarks for sediments, relevant to human health, for the COPCs that have been identified in the Assessment Area;
- Identify chemical benchmarks for tissues, relevant to human health, for the COPCs that have been identified in the Assessment Area;
- Determine if the levels of the COPCs in whole sediments are sufficient to alter the chemical composition of fish or shellfish tissue to such an extent that the human uses of fishery resources would be adversely affected in the Assessment Area;
- Determine if the levels of the COPCs in fish tissues are sufficient to cause or substantially contribute to injury to human uses of fishery resources in the Assessment Area;
- Identify COCs in sediments and fish tissues (i.e., the substances that occur at concentrations sufficient to cause or substantially contribute to injury to human uses of fishery resources) in the Assessment Area; and,
- Determine the areal and temporal extent of injury to human uses of fishery resources in the Assessment Area.

Definitions of many of the terms that have been used in this document are provided in the Glossary of Terms and the List of Acronyms that appear at the beginning of this report.

2.0 Background

This study was conducted as part of a broader NRDA that is intended to assess injuries to a variety of natural resources that are associated with discharges of oil or releases of other hazardous substances within the Assessment Area (Natural Resources Trustees 1997; Simon *et al.* 2000). To support the development and communication of a plan for assessing natural resource damages, Natural Resources Trustees (1997) compiled relevant background information on the Assessment Area. This background information included a description of the geographic scope of the Assessment Area, the history of industrial activities within that area, the nature of the hazardous substance and oil releases into the environment, and the natural resources subject to injury resulting from these releases. Portions of this Assessment Plan for the NRDA (Natural Resources Trustees 1997) have been reproduced here (with minor edits) to provide the reader with enhanced access to this important background information.

2.1 Geographic Scope of the Assessment Area

This NRDA focuses on the Grand Calumet River, IHC, IH, and associated Lake Michigan environments, and on the riparian and upland habitats closely associated with these waters, including lands within the boundaries of the Indiana Dunes National Lakeshore. The following descriptions establish more specific boundaries for what will be referred to as the "Assessment Area".

2.1.1 Grand Calumet River

The Grand Calumet River comprises two east-west oriented branches that meet at the southern end of the IHC. The EBGCR originates at the GCRL, just east of the U.S. Steel Gary Works facility. The EBGCR flows west from this point for approximately 10 miles to its confluence with the IHC. The WBGCR usually flows both east and west, with a hydraulic divide typically present in the vicinity of Columbia Boulevard. The Assessment

Area includes the GCRL, the reach of the EBGCR from the first railway bridge located upstream of Industrial Highway (ConRail Bridge) to the confluence with the IHC, and the reach of the WBGCR between Indianapolis Boulevard and the IHC, along with the riparian, wetland, and upland habitats closely associated with these stretches of the river. In this report, the additional reaches of the EBGCR and WBGCR (i.e., EBGCR-II and WBGCR-II) were also considered to provide a more comprehensive assessment of injury to human uses of fishery resources (Figure 2).

2.1.2 Indiana Harbor Canal, US Canal, and Indiana Harbor

The IHC flows north for approximately two miles from its confluence with the east and west branches of the Grand Calumet River to the junction with LGB (which is often termed the Forks). The LGB of the canal extends to the west from the point where the main canal turns to the northeast. The USC extends in a northeasterly direction for about two miles from the Forks to IH. This portion of the Assessment Area includes all of the Federal Project Area.

2.1.3 Lake Michigan

The trustees have not defined a specific boundary within which Lake Michigan resources will be subject to assessment. The establishment of such a boundary depends upon a better understanding of injuries to Grand Calumet River and IHC resources and the nature of the relationship between the river and canal and the lake. At a minimum, the trustees committed to review existing information and assess the extent to which the Grand Calumet River and IHC contribute to the degradation or diminishment in value of lake resources and the services these resources provide.

2.1.4 Indiana Dunes National Lakeshore

The Indiana Dunes National Lakeshore is a unit of the National Park system comprising more than 12,000 acres east of and adjacent to the U.S. Steel Gary Works. The trustees included the Indiana Dunes National Lakeshore in the Assessment Area due to the park's proximity to known sources of contamination. The focus of trustee efforts was on the western portion of the park, including portions of the GCRL system. The GCRL are also known as the Marquette Park Lagoons.

2.1.5 Division of Assessment Area into Geographic Areas

To facilitate this evaluation, the Assessment Area was initially divided into nine separate reaches, including the Grand Calumet River Lagoons (GCRL), East Branch Grand Calumet River-I (EBGCR-I), East Branch Grand Calumet River-II (EBGCR-II), West Branch Grand Calumet River-I (WBGCR-I), West Branch Grand Calumet River-II (WBGCR-II), Indiana Harbor Canal (IHC), Lake George Branch (LGB), US Canal (USC) and Indiana Harbor/Lake Michigan (IH/LM; i.e., consistent with the approach used by MacDonald and Ingersoll 2000). In each of these reaches, the available sediment quality, tissue quality, and related information was collected, evaluated, and compiled. Subsequently, the data on seven of the nine reaches was consolidated to support the assessment of injury to human uses of fishery resources within the Grand Calumet River and Indiana Harbor Canal (GCR/IHC). Injury to human uses of fishery resources was also evaluated within the GCRL and IH/LM. Division of the Assessment Area into these three areas (Figure 3) facilitated implementation of a geographically consistent approach to the assessment of injury to human uses of fishery resources using all three of the indicators that were selected [i.e., sediment chemistry, tissue chemistry, and fish consumption advisories (FCAs); i.e., FCAs have been issued for these three geographic areas only].

2.2 Chemicals of Potential Concern in the Assessment Area

The trustees have focused the assessment on natural resource injuries and damages which are associated with the release of PCBs, oil and oil-related compounds, and metals. The purpose of this section is to briefly describe these three categories of chemicals, focusing on general characteristics, sources and environmental effects. Additional COPCs were identified as part of this assessment, but are not described in detail here (see Section 1.0).

2.2.1 Polychlorinated Biphenyls

PCBs are synthetic compounds that were produced commercially in the United States between 1929 and 1977, when their production in this country was subsequently banned. The principal manufacturer of PCBs in the United States was the Monsanto Chemical Co. Monsanto's PCBs were sold under the registered trademark of Aroclor.

PCBs found wide use in commercial and industrial applications due to their favorable properties, including chemical stability, low flammability, and ability to serve as an electrical insulator. Common uses of PCBs ranged from dielectric fluids in capacitors and transformers, to heat transfer fluids, hydraulic fluids, lubricating and cutting oils, to additives in pesticides, paints, copying paper, adhesives, sealants and plastics. Their most common use was in capacitor and transformer dielectric fluids. As a result of their widespread use, the release of PCBs to the environment can occur through a variety of mechanisms, including past uncontrolled use, past disposal practices, illegal disposal, and accidental releases (Erickson 1997).

The chemical stability of PCBs makes them highly persistent in the environment after they have been released. Because they are have relatively high octanol-water partitioning coefficients and low water solubilities, PCBs tend to accumulate in soils and sediments. Having accumulated in these environmental media, PCBs become available to biological organisms, typically moving through the food chain from invertebrates to fish, birds, mammals, and other wildlife. Despite general declines in observed concentrations of PCBs in wildlife since the manufacture of PCBs ceased more than twenty years ago, concentrations still occur at levels that are sufficient to cause adverse effects in exposed organisms. The results of field and laboratory studies indicate that PCBs can be associated with a range of such effects, including impaired reproductive ability in fish, mammals, and birds (Beyer *et al.* 1996; Eisler 1986).

2.2.2 Oil and Oil-Related Compounds

Oil is a term used to classify a variety of complex mixtures of organic compounds and trace elements that are commonly associated with the petrochemical industry. In general, four classes of petroleum hydrocarbons make up the non-animal or plant oils: alkanes, naphthenes, aromatics, and alkenes. Crude or refined oils have the potential to enter the environment wherever they are used, manufactured, stored, or otherwise handled. Releases to the environment can occur as a result of direct discharge to the land surface or to surface water, and can move through the environment via numerous pathways, including the discharge of ground water to surface water, and surface water runoff. Oil can be harmful to the environment as a result of both its physical and chemical properties.

A subcategory of the aromatic hydrocarbons is the group of chemicals known as PAHs. In addition to their occurrence as constituents in petroleum products, PAHs are also formed as a product of incomplete combustion. Sixteen PAHs are classified as priority pollutants by the USEPA. Exposure to PAHs has been associated with a variety of adverse effects in fish, birds, mammals, and other wildlife, including reduced growth, impaired reproduction, and mortality (Beyer *et al.* 1996).

2.2.3 Metals

Metals are naturally-occurring elements that are often found, as a result of industrial and commercial activity, at elevated concentrations in the environment. The group of metals that can be toxic, particularly at high doses, are commonly referred to as the "heavy metals." These metals include aluminum, arsenic, beryllium, bismuth, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, strontium, thallium, tin, titanium, and zinc. Cadmium, lead, and mercury are among the more prominent metals which have been associated with adverse effects observed in natural resources. Adverse effects associated with exposure to metals have been observed in invertebrates, fish, birds, and mammals, including reduced growth, impaired reproduction, and mortality (Beyer *et al.* 1996).

2.3 Natural Resources in the Assessment Area

Prior to the period of industrial development, the Assessment Area was characterized by a plain of coastal sediments, the most prominent features of which were the globally-rare dune and swale habitats running parallel to the shoreline. Today only scattered dune and swale remnants are preserved. Nevertheless, the Grand Calumet River and IHC environment continues to comprise a wide range of resources. Importantly, the area has the capacity to support a much richer and much more diverse suite of resources than are currently present.

The USDOI regulations (CFR 2002) define five categories of natural resources for which natural resource damages may be sought: surface water resources, ground water resources, air resources, geological resources, and biological resources. Surface water resources include both the water column and associated bed or bank sediments. The following sections briefly describe each of these categories in the context of the Assessment Area.

2.3.1 Surface Water Resources

The surface water resources in the Assessment Area are particularly important in the context of this damage assessment, as they have been and continue to be the principle receptors of hazardous substances, including oil, released to the environment. The contamination of these resources has both direct and indirect impacts on the health of biological resources. For example, contaminated sediments can cause injury to benthic invertebrate populations, which in turn can result in injuries to resident fish populations for whom the invertebrates are a source of food. Similarly, injury to invertebrates and/or fish resulting from exposure to contaminated sediments and surface water can lead to injury in local insectivorous (i.e., insect-eating) or piscivorus (i.e., fish-eating) bird populations. In addition, contaminated sediments serve as a source of continuing releases of hazardous substances to the water column.

2.3.2 Ground Water Resources

Ground water resources include the water in a saturated sub-surface zone and the rocks or sediments through which this water flows. Ground water resources serve as a potential pathway for contaminants to migrate from their source to surface water resources. Since ground water within the Assessment Area is not used as a public drinking water supply (as a result of contamination), the assessment of these resources focused on establishing if the groundwater resource represents a pathway for contaminants to migrate to surface water resources. The Calumet Aquifer, a shallow ground water aquifer within the Assessment Area, has been documented to be directly connected with the waters of the Grand Calumet River, IHC, and Lake Michigan (IDEM 1991). Injury to ground water resources has been evaluated in a separate report.

2.3.3 Air Resources

Air resources are typically assessed in the context of their ability to serve as a pathway for hazardous substances to reach, and potentially injure, other resource categories. The trustees did not consider an assessment of the air pathway to be a cost-effective use of assessment resources.

2.3.4 Geologic Resources

Geologic resources include soils and sediments that are not otherwise accounted for under the definition of surface water or ground water resources. In this NRDA, geologic resources include the soils and sediments located in upland and wetland areas closely associated with the Grand Calumet River, and the soils of lands within the Indiana Dunes National Lakeshore.

2.3.5 Biological Resources

Along with surface water resources, biological resources comprise a key component of this damage assessment. In this assessment, the trustees focused on evaluating injuries to three categories of biological resources: benthic invertebrates, fish, birds, and mammals. However, it was understood that other ecosystem components, such as amphibians and reptiles, can also be adversely affected by contaminated sediments and should be considered when sufficient information is available to do so.

3.0 Study Approach

A step-wise approach was used in this report to assess injury to human uses of fishery resources in the Assessment Area. The six main steps in this process included:

- Identification of key indicators for assessing injury to human uses of fishery resources;
- Collection, evaluation, and compilation of the existing information on key indicators of injury to human uses of fishery resources in the Assessment Area;
- Selection of chemical benchmarks for assessing injury to human uses of fishery resources in the Assessment Area (including bioaccumulation-based benchmarks for sediment quality and tissue residue benchmarks for the protection of human health);
- Assessment of injury to human uses of fishery resources within the three major areas of the Assessment Area (Figure 3);
- Identification of COCs in the Assessment Area; and,
- Determination of the areal and temporal extent of injury to human uses of fishery resources in the Assessment Area.

Each of these steps is described in the following sections of this report.

3.1 Identification of Key Indicators for Assessing Injury to Human Uses of Fishery Resources

This investigation was conducted to determine if biological resources within the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, Indiana Harbor and the nearshore areas of Lake Michigan (i.e., the Assessment Area) have been injured due to discharges of oil or releases of other hazardous substances, as defined in 43 CFR §

11.62(f)(1)(ii and iii) in the USDOI regulations for conducting NRDAs (CFR 2002). In this report, the term injury to human uses of fishery resources has been used to more specifically describe such injuries to biological resources. This assessment of injury to human uses of fishery resources was conducted to determine if the concentrations of COPCs in whole sediments and/or fish tissues are sufficient to adversely affect human health and/or the human uses of fishery resources. Therefore, it was necessary to identify key indicators for assessing injury to human uses of fishery resources. A total of three types of information were used, as available, to evaluate injury to human uses of fishery resources, including:

- Chemistry of whole sediments;
- Chemistry of fish tissues; and,
- Presence of FCAs.

While any of these indicators could be used alone to determine if injury to human uses of fishery resources has occurred within the Assessment Area, agreement among multiple indicators of injury increases the level of confidence that can be placed on the overall evaluation. The benchmarks that were used to evaluate the information on these three indicators of injury to human uses of fishery resources are described in Section 3.3.

3.2 Collection, Evaluation, and Compilation of Data and Related Information on Key Indicators

Information on the chemical characteristics of sediments and fish tissues in the Assessment Area was collected from a variety of sources to support this assessment of injury to human uses of fishery resources. Importantly, USFWS and IDEM forwarded copies of a number of reports that provided information on sediment and fish tissue quality conditions within the Assessment Area, including the results of several recent investigations that were conducted explicitly to support the current assessment (i.e., Tetra Tech EM Inc. 1998; Maxim Technologies 1999; IDEM 1999; Table 1). In addition, the fish tissue chemistry data that have been assembled by the State of Indiana to support the development of the statewide

FCA were obtained directly from IDEM. Information on the FCAs that have been issued recently (i.e., since 1995) for the Grand Calumet River and Indiana Harbor Canal was obtained by accessing the Indiana FCA reports. Information on the FCAs that were issued prior to 1995 was obtained by contacting representatives of the Indiana State Department of Health (ISDH) and IDEM.

All of the data sets that were retrieved during the course of the study were critically reviewed to determine their applicability to the assessment of injury to human uses of fishery resources in the Assessment Area. The criteria that were used to evaluate each of the candidate data sets are described in Appendix 2 of this report. The data sets that contained information on the Assessment Area and met the selection criteria were incorporated into electronic data files (in MS Excel format). These data were subsequently fully verified against the original data source.

Several types of data were compiled as part of this study. First, the information of the chemical composition of whole sediments (Appendix 3) was compiled for both surficial and sub-surface sediment samples. The data summaries for each geographic area, and the entire Assessment Area, include the number of samples collected (n), 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles, geometric mean and standard deviation, mean, and range for each COPC (See Appendix 4). In addition, information on the levels of COPCs in the tissues of fish were also assembled, as available (Figures 9 to 53; Appendix 5). Other relevant data, such as information on conventional indicators of sediment quality conditions (i.e., NH_3, SOD, TOC, and DO) were also obtained from the studies that were assembled on the Assessment Area.

In a number of studies, additional sediment or fish tissue samples were collected and/or analyzed as part of the quality assurance program. In this report, field replicate samples were treated as unique samples in the data analyses (i.e., by providing information on the small scale spatial variability in sediment quality conditions). By comparison, laboratory split samples were treated as duplicates and averaged to support subsequent data analysis.

Several types of fish tissue samples have been collected within the Assessment Area, including whole body, skin-on fillets, and skin-off fillets. The data on the concentrations of COPCs in skin-on fillets and skin-off fillets were used directly to assess injury to human uses of fishery resources. However, the tissue residue data for whole body samples were first converted to corresponding levels in fish fillets before using them in the assessment of injury to human uses of fishery resources. More specifically, the USEPA-recommended conversion factors (i.e., 0.7 for mercury and 1.35 for pesticides and PCBs) were used to estimate COPC concentrations in fillets from the whole body data (USEPA 2000).

To support subsequent interpretation of the sediment and tissue chemistry data, the total concentrations of several chemical classes were determined for each sediment sample. For PCBs in sediment, the concentrations of total PCBs were determined using various procedures, depending on how the data were reported in the original study. If only the concentrations of total PCBs was reported in the study, then those values were used directly. If the concentrations of various Aroclors (e.g., Aroclor 1242, Aroclor 1248) were reported, then the concentrations of the various Aroclors were summed to determine the concentration of total PCBs. In fish tissue samples, the reported concentration of total PCBs was used preferentially because such results were available for all samples. For DDTs, the concentrations of p,p'-DDD and o,p'-DDD, p,p'-DDE and o,p'-DDE, and p,p'-DDT and o,p'-DDT were summed to calculate the concentrations of sum DDD, sum DDE, and sum DDT, respectively. Total DDTs was calculated by summing the concentrations of sum DDD, sum DDE, and sum DDT. In tissue residue samples, the sum concentrations of aldrin and dieldrin, as well as heptachlor and heptachlor epoxide were determined. Finally, the concentrations of chlordane in sediment were determined by summing the concentrations of alpha- and gamma-chlordane isomers. If only the concentrations of total chlordane were reported in the study, then those values were used directly. In tissue residue samples, the concentration of total chlordane was determined by summing the concentrations of up to five isomers (i.e., alpha- and gamma-chlordane, cis- and trans-nonachlor, and oxychlordane).

Less than detection limit data was treated in several ways, depending on the guidance that has been provided in conjunction with the chemical benchmarks for sediment chemistry and tissue chemistry. In calculating the total concentrations of the various classes of COPCs in sediments, less than detection limit values were assigned a value of one-half of the detection, except when the detection limit was greater than the selected chemical benchmark. In this latter case, the greater than detection limit value was not used in the calculation of the total concentration of the substance or in the assessment of injury to human uses of fishery resources. For tissue samples, less than detection limit data and low level detects were treated as zero in accordance with the guidance provided by the USFDA (2001) to facilitate comparison with the tolerance or action levels. By comparison, less than detection limit data for tissue chemistry were assigned a value of one-half of the detection to facilitate comparison with the thresholds used to develop the Indiana FCAs (Anderson *et al.* 1993). When the detection limit was greater than the selected benchmark for fish tissue chemistry, then the result was not used in the assessment of injury to human uses of fishery resources.

To support the compilation and subsequent analysis of the information on sediment chemistry and tissue chemistry, a relational project database was developed in MS Access format. To the extent possible, the sediment chemistry and tissue chemistry data compiled in the database were georeferenced to facilitate mapping and spatial analysis using geographic information system (GIS)-based applications [i.e., Environmental Systems Research Institute, Inc. (ESRI's) ArcView and Spatial Analyst programs]. In some cases sample locations were estimated using maps or descriptions provided in the report). The database structure made it possible to retrieve data in several ways, including by data type (i.e., sediment chemistry vs. tissue chemistry), by sediment horizon (i.e., surficial vs. sub-surface sediments), by fish species (carp vs. gizzard shad), by geographic area [i.e., GCRL vs. Grand Calumet River and the Indiana Harbor Canal (GCR/IHC)], and by date. As such, the database facilitated a variety of different types of data analyses.

3.3 Selection of Benchmarks for Assessing Injury to Human Uses of Fishery Resources

A total of three indicators were selected for assessing injury to human uses of fishery resources associated with releases of oil or discharges of other hazardous substances in the Assessment Area. As such, assessment of injury to human uses of fishery resources necessitated the identification and application of three types of benchmarks, including:

- Chemical benchmarks for assessing potential effects on human health associated with the bioaccumulation of COPCs from contaminated sediments (Table 2);

- Chemical benchmarks for assessing potential effects on human health associated with the consumption of contaminated fish and shellfish tissues (Tables 3 and 4); and,
- Criteria for assessing the effects on the human uses of fishery resources associated with the issuance of FCAs.

The benchmarks or criteria that were selected to support the current assessment of injury to human uses of fishery resources in the Assessment Area are described in the following sections.

Sediment Chemistry - Many of the COPCs in the Assessment Area have the potential to accumulate in the tissues of sediment-dwelling organisms. Because many benthic and epibenthic species represent important components of the food web, sediment-associated COPCs can be transferred to higher trophic levels in aquatic food webs (e.g., fish and shellfish). In this way, contaminated sediments represent a potential hazard to humans that consume aquatic organisms. While assessments of bioaccumulation can be conducted in several ways, bioaccumulation-based sediment quality guidelines (SQGs) provide practical tools for evaluating sediment quality relative to the potential for adverse effects on human health associated with the accumulation of COPCs in the tissues of aquatic organisms (Cook *et al.* 1992).

Bioaccumulation-based SQGs are important tools for conducting sediment quality assessments for several reasons. First and foremost, bioaccumulation-based SQGs explicitly consider the potential for accumulation of sediment-associated COPCs in fish and shellfish. In addition, the bioaccumulation-based SQGs provide a basis for interpreting sediment chemistry data in terms of the potential for adverse effects on human health. Therefore, sediment chemistry data, relative to bioaccumulation-based SQGs for the protection of human health, were used in this report as indicators for assessing injury to human uses of fishery resources in the Assessment Area.

Bioaccumulation-based SQGs define the concentrations of individual chemicals or classes of chemicals in sediments that will not result in unacceptable levels of COPCs in the tissues of aquatic organisms (Ingersoll *et al.* 1997). The first step in the development of such SQGs involves the derivation or selection of an appropriate tissue residue benchmark for the substance or substances under consideration (e.g., action levels or tolerance levels established under Section 402 of the Food, Drug, and Cosmetic Act). In addition, relationships between concentrations of COPCs in sediments and chemical residues in aquatic biota must be established. In general, the necessary lipid- and carbon-normalized biota-sediment bioaccumulation factors (BSAFs) are determined from field studies or estimated using various modeling approaches. The SQGs are then derived by dividing the tissue residue benchmark by the BSAF (Cook *et al.* 1992).

At least two jurisdictions in the United States have established numerical bioaccumulation-based sediment quality criteria (SQCs) for the protection of human health, including the New York State Department of Environmental Conservation (NYSDEC 1999) and the Washington State Department of Health (WSDOH 1995; 1996). The SQCs that were promulgated by the NYSDEC (1999) were derived for various COPCs using the equilibrium partitioning approach. Using this approach, a numerical SQC was derived for a substance by multiplying the bioaccumulation-based water quality criterion (WQC) by the corresponding octanol-water partition coefficient (K_{ow}). One of the assumptions underlying this approach is that bioaccumulation of sediment-associated COPCs occurs primarily due to exposure to pore water. By comparison, the SQCs that were established by the WSDOH (1995; 1996) were generated using a risk-based procedure that more explicitly considers the various exposure routes that can lead to the accumulation of COPCs in the tissues of aquatic organisms. More specifically, a numerical SQC was derived for a substance by dividing the tolerable concentration of the substance in tissues by the product of the lipid content of the tissue and the BSAF. As the BSAF can be established using field studies or modeling, it typically considers exposure of aquatic organisms to COPCs via multiple routes. In both cases, the resulting SQCs are expressed on an organic carbon-normalized basis.

In this investigation, the SQCs that were established by the WSDOH (1995;1996) were selected for assessing injury to human uses of fishery resources in the Assessment Area. These SQCs were selected because they more directly address the exposure pathways of concern within the Assessment Area. That is, the selected SQCs explicitly consider the bioaccumulation of COPCs due to exposure from all sources (i.e., as evaluated primarily by field-derived BSAFs) rather than from exposure to pore water only. Sediment samples with concentrations of one or more COPCs in two or more samples (separated by 100 feet) in excess of the selected chemical benchmarks were considered to have conditions sufficient to injure human uses of fishery resources. A listing of the SQCs that have been established by the WSDOH (1995;1996) for the protection of human health is presented in Table 2.

Tissue Chemistry - Although many sediment-associated COPCs can adversely affect sediment-dwelling organisms, concerns relative to human health are primarily associated with those substances that accumulate in the tissues of sediment-dwelling organisms. Because many benthic and epibenthic species represent important components of the food web, sediment-associated COPCs can be transferred to higher trophic levels, such as fish and shellfish. In this way, contaminated sediments represent a potential hazard to human health (i.e., dietary exposure).

Data on the concentrations of COPCs in the tissues of aquatic organisms (i.e., fish and shellfish) provides important information for assessing the potential effects of discharges of oil or releases of other hazardous substances on human health. More specifically, tissue chemistry data provide information on the extent to which bioaccumulative substances have accumulated in the tissues of sediment-dwelling organisms and fish and shellfish. Comparison of these data to relevant tissue residue benchmarks provides a basis for determining if COPCs have accumulated in the tissues of aquatic organisms to such an extent that adverse effects on human health could occur if those tissues were consumed by the human population.

In this investigation, the data on the levels of COPCs in fish tissues were compared to two types of tissue residue benchmarks. First, the tissue chemistry data were compared to the action levels or tolerance levels that have been established by the USFDA under Section 402 of the Food, Drug, and Cosmetic Act (21 U.S.C. 342) for the edible portions of fish and shellfish. A summary of the historic and current tolerance levels and action levels that have been established by the United States Food and Drug Administration (USFDA) for selected environmental contaminants and pesticides (i.e., PCBs, methylmercury, chlordane, DDT and metabolites, aldrin and dieldrin, heptachlor and heptachlor epoxide, chlordecone (kepone), and mirex are presented in Table 3. Because most of the mercury in fish tissues occurs as methylmercury, the USFDA action level of methylmercury was applied to the data on the levels of mercury in fish tissues. The USFDA refined the tolerance level for PCBs in 1984 and the action level for methylmercury in 1979 (Table 3); the benchmark that was in effect the year tissue samples were collected was applied to the tissue chemistry data for the purposes of identifying exceedances of the relevant tissue chemistry benchmarks.

Although the USFDA action levels and tolerance levels provide important tools for evaluating fish and shellfish tissue quality (especially for fish and shellfish that are caught and sold commercially), there is general agreement that these benchmarks are not adequately protective of public health (Anderson *et al.* 1993). For this reason, the Great Lakes Sport Fish Consumption Advisory Task Force developed a protocol for establishing uniform sport FCAs in the Great Lakes that would maintain the health benefits associated with fish consumption, minimize the potential for angler exposure to toxic chemicals, use credible and understandable science, and present the information in a manner conducive to maximal voluntary compliance (Anderson *et al.* 1993). The cornerstone of this protocol is the derivation of a health protection value (HPV) for each substance that is associated with tolerable cancer and/or developmental/reproductive risks (i.e., an acceptable daily intake rate or reference dose). The HPV is then used, together with information on the body weight of the target consumer group, the daily consumption rate of fish tissues, and reductions in chemical concentrations during preparation and cooking, to establish thresholds (i.e., concentration ranges) for categorizing fish into one of five advisory groups (i.e., Groups 1 to 5; Stahl and Simon 2000). The recommended spacing (e.g., one meal per week) of Indiana sport-caught fish meals are then specified for each advisory group. Restrictions on the consumption of sport-caught fish are advised when the upper threshold for Group 1 fish is exceeded (note: although there are no restrictions on consumption for fish species with COPC concentrations less than the Group 1 advisory threshold, there are recommendations to limit consumption of undesignated species in named waterways and all waterways not listed in the advisory). Such thresholds are currently available for mercury (0.16 milligrams/kilogram wet weight (mg/kg WW) and total PCBs (50 :g/kg WW for skin-on scaleless fillets) only (Table 4; Stahl and Simon 2000).

For the purposes of identifying exceedances of the tissue chemistry benchmarks, the tissue chemistry data were compared to the relevant threshold level for the two types of sample preparations (i.e., skin on scaleless fillets and skin off fillets). Tissue samples with concentrations of one or more COPCs in one or more samples in excess of the selected chemical benchmarks were considered to have conditions sufficient to injure human uses of fishery resources.

Fish Consumption Advisories - Although data on sediment chemistry and tissue chemistry provide important information for assessing the potential effects of sediment- and tissue-associated COPCs on human health, the actual hazards posed by bioaccumulative substances can be mitigated, at least in part, through the issuance of FCAs. Such FCAs are intended to provide human consumers of fish and shellfish with information regarding the benefits and risks associated with the consumption of sport-caught fish. Because recreational and subsistence fishing are socially-, economically-, and culturally-important activities, the issuance of FCAs represents an injury to human uses of fishery resources. Under the USDOI regulations (CFR 2002), biological resources have been injured if edible fish and/or shellfish tissues contain concentrations of a hazardous substance sufficient to exceed levels for which an appropriate state health agency has issued directives to limit or ban the consumption of such tissues (43 CFR § 11.62). The issuance of a FCA (i.e., restrictions on fish and wildlife consumption) is also considered to be a use impairment under the Great Lakes Water Quality Agreement (IJC 1997).

In Indiana, responsibility for issuing FCAs is vested in ISDH, IDEM, and the Indiana Department of Natural Resources (IDNR). Each year, representatives from these three agencies meet to discuss the recent fish monitoring data and to develop the new statewide FCA (e.g., ISDH, IDEM, and IDNR 2002). Such FCAs are developed using risk-based procedures that consider the segment of the population that may be adversely affected by consuming fish tissues (e.g, adult males, women planning to have children, pregnant or breast-feeding women, and children), the frequency of consumption of tissue-associated COPCs, source of the fish (i.e., water body), and the levels of COPCs in the tissues of fish of various species and sizes from each water body. Accordingly, fish of various species and sizes are classified into one of five categorical groups for each water body, which specify the recommended frequency of consumption of Indiana sport-caught fish, including:

- Group 1: *General Population* - unlimited consumption for adult males and females; *Sensitive Population* - restrict consumption to one meal per week for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15;

- Group 2: *General Population* - restrict consumption to one meal per week for adult males and females; *Sensitive Population* - restrict consumption to one meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15;

- Group 3: *General Population* - restrict consumption to one meal per month for adult males and females; *Sensitive Population* - no consumption for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15;

- Group 4: *General Population* - restrict consumption to one meal every two months for adult males and females; *Sensitive Population* - no consumption for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15; and,

- Group 5: *General and Sensitive Population* - no consumption.

In this investigation, the issuance of Group 2, 3, 4, or 5 FCAs on one or more fish species (and/or size classes) was considered to provide the necessary and sufficient evidence of an injury to human uses of fishery resources within the Assessment Area.

3.4 Assessment of Injury to Human Uses of Fishery Resources

Discharges of oil or releases of other hazardous substances into aquatic ecosystems have the potential to cause injury to surface water resources and/or to biological resources (Natural Resources Trustees 1997), including sediments, sediment-dwelling organisms, wildlife, and/or human health. Assessments of injury to sediments, sediment-dwelling organisms, and wildlife within the Assessment Area were conducted previously (Ingersoll and MacDonald 1999; MacDonald and Ingersoll 2000). This investigation was conducted to determine if biological resources within the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, Indiana Harbor and the nearshore areas of Lake Michigan (i.e., the Assessment Area) have been injured due to discharges of oil or releases of other hazardous substances, as defined in 43 CFR § 11.62(f)(1)(ii and iii) in the USDOI regulations for conducting NRDAs (CFR 2002). In this report, the term injury to human uses of fishery resources has been used to more specifically describe such injuries to biological resources. The definitions of injury to biological resources included in the USDOI regulations were generally applied in this investigation to assess the effects of chemical contamination on human use and consumption of fish and shellfish (i.e., injury to human uses of fishery resources). Injury to human uses of fishery resources was assessed for each of the areas defined above [i.e., the GCR/IHC, GCRL, and Indiana Harbor/ Lake Michigan (IH/LM)]. Three separate lines of evidence were used to determine if injury to human uses of fishery resources had occurred in these geographic areas. More specifically, injury to human uses of fishery resources was considered to have occurred if:

- The concentrations of one or more COPCs in two or more whole-sediment samples from an area (i.e., separated by more than 100 feet) exceeded the selected chemical benchmarks for the protection of human health;
- The concentrations of one or more COPCs in one or more fish tissue samples from an area exceeded the selected chemical benchmarks for the protection of human health (i.e., the tolerance levels or action levels that have been established by the USFDA or the thresholds that have been used by the State of Indiana to establish FCAs); or,
- FCAs have been issued for one or more species of fish within an area.

3.5 Identification of Contaminants of Concern in Sediments and Fish Tissues

In this report, COCs are defined as those substances that occur in sediments and/or fish tissues at concentrations that are sufficient to cause or substantially contribute to injury to human uses of fishery resources. The COCs were identified by comparing the concentrations of each substance that has been measured in whole sediment and fish tissue samples to the corresponding chemical benchmarks. The chemical benchmarks that were used in this evaluation included the published bioaccumulation-based SQCs for the protection of human health (Table 2) and the published tissue residue benchmarks for the protection of human health [including the tolerance levels or action levels that have been established by USFDA (2001) and the thresholds that have been used by the State of Indiana to establish FCAs - Stahl and Simon 2000; Tables 3 and 4]. Those substances that occurred in sediments or fish tissues within a geographic area at concentrations in excess of the selected chemical benchmarks were identified as sediment-associated or tissue-associated COCs (i.e., in two or more sediment samples or one or more tissue samples). In addition, the FCAs that have been issued for the three portions of the Assessment Area (i.e., GCR/IHC, GCRL, and IH/LM) were reviewed to determine which substance or substances were considered to be responsible for the risk to human health. A substance that was identified as a COPC and that was identified as either a tissue-associated COC or a substance that had driven one or more FCAs was designated as a principal COC. Substances that were identified as sediment-associated COCs, but for which there were no available tissue benchmarks or measured tissue chemistry (i.e., not identified as tissue-associated COCs) were not identified as principal COCs. The principal COCs are those substances that have been demonstrated to be associated with injury.

3.6 Evaluation of the Spatial and Temporal Extent of Injury to Human Uses of Fishery Resources

In this evaluation, sediment chemistry, tissue chemistry, and FCAs were used as the primary indicators of injury to human uses of fishery resources. To facilitate an evaluation of the spatial extent of injury to human uses of fishery resources, the available sediment chemistry and tissue chemistry data were tabulated for each of the three geographic areas within the Assessment Area (i.e., GCR/IHC, GCRL, and IH/LM). As such, it was possible to calculate the proportion of sediment or tissue samples within each geographic area that had levels of chemical contamination that were sufficient to cause or substantially contribute to injury to human uses of fishery resources. Human uses of fishery resources within geographic areas with two or more sediment samples (separated by more than 100 feet) with elevated levels of sediment-associated COPCs (as indicated by one or more exceedances of the selected chemical benchmarks) were considered to have been injured by discharges of oil or releases of other hazardous substances. Likewise, geographic areas with one or more fish tissue samples with elevated levels of COPCs (as indicated by one or more exceedances of the selected chemical benchmarks) were considered to have conditions sufficient to injure human uses of fishery resources.

Although sediment chemistry and tissue chemistry data were used to identify the presence of conditions sufficient to injure human uses of fishery resources, the spatial and temporal extent of injury to human uses of fishery resources was evaluated using information on the FCAs than have been issued for the Assessment Area. More specifically, the information on the scope of the geographic area that was covered by a FCA was used to identify the spatial extent of injury to human uses of fishery resources. By comparison, the temporal extent of injury to human uses of fishery resources was evaluated by compiling the information on the FCAs that were issued for each geographic area each year and determining the number of years that such FCAs were in effect.

4.0 Existing Information Relevant to Human Uses of Fishery Resources in the Assessment Area

This report was prepared to determine if discharges of oil or releases of other hazardous substances have caused or substantially contributed to injury to human uses of fishery resources within the Assessment Area. The geographic scope of the Assessment Area is outlined in Figures 1, 2, and 3. To support the assessment of sediment injury, MacDonald and Ingersoll (2000) divided the Assessment Area into nine separate reaches (Figure 2). By comparison, the Assessment Area was divided into three geographic areas in this investigation to facilitate assessment of injury to human uses of fishery resources, including:

- Grand Calumet River/Indiana Harbor Canal [GCR/IHC; which includes the East Branch of the Grand Calumet River (EBGCR-I and EBGCR-II), West Branch of the Grand Calumet River (WBGCR-I and WBGCR-II), Indiana Harbor Canal (IHC), Lake George Branch (LGB), and US Canal (USC)];
- Grand Calumet River Lagoons (GCRL); and,
- Indiana Harbor and the nearshore areas of Lake Michigan (IH/LM; i.e., including the inner harbor, the outer harbor, and nearshore areas of the lake).

This alternate system for dividing up the Assessment Area was adopted because it corresponds with the geographic areas that were used by ISDH, IDEM, and IDNR (2002) to develop the Indiana FCA.

This assessment was conducted using data and information on sediment chemistry, fish tissue chemistry, and FCAs that have been collected over roughly the past 25 years. Over that time, a substantial quantity of data on environmental conditions has been collected in the Assessment Area. In total, more than 120 documents relating to the Assessment Area were identified and retrieved to acquire candidate data sets for possible inclusion in the project database. Each of these studies was then critically reviewed to determine if it contained relevant information for assessing injury to human uses of fishery resources within the Assessment Area (see Appendix 2 for a listing of the criteria that were used to evaluate candidate data sets). A brief description of each study is provided in the following sections, including the reaches that were sampled and the types of data that were reported in the study.

4.1 Data Collected During the Period, 1980 to 1989

In 1980, the United States Army Corps of Engineers (USACE; Waterways Experiment Station) conducted a study to evaluate the physical and chemical characteristics of sediment and water from the USC (USACE 1980). In this study, sediment samples from three sites were collected and analyzed for total metals, oil and grease, total PCBs, phenols, and several conventional variables (including TOC).

The collection of fish tissue samples from the Grand Calumet River system was initiated by IDEM (2000a) in 1980 (n=1), with additional sampling conducted in 1982 (n=2), 1984 (n=2), 1986 (n=13), 1987 (n=5), and 1988 (n=8). This initiative, which has come to be known as the Tissue Contaminant Monitoring Program, resulted in the collection of the edible tissues of five fish species during the 1980's, including carp (*Cyprinus carpio*), largemouth bass (*Micropterus salmoides*), pumkinseed (*Lepomis gibbosus*), longnose sucker (*Catostomus catostomus*), and yellow perch (*Perca flavescens*). The tissues (whole body and skin-on fillets) of these fish were then analyzed to determine the concentrations of COPCs, including total metals, pesticides, PCBs, acid extractable compounds, base/neutral extractable compounds, and volatile organic compounds (VOCs).

In September of 1987, the Metropolitan Sanitary District of Greater Chicago initiated a sediment survey to obtain information on the fate of contaminated sediments drifting from IH into Lake Michigan (Polls 1988). This study was designed to support the development of maintenance dredging plans by the USACE. Surficial sediment samples were collected from a total of 30 stations, including one in the LGB, two in the USC, and 27 from IH/LM. Each sediment sample was analyzed for selected metals, PCBs, and TOC.

In 1988, IDEM initiated a monitoring program to evaluate sediment quality conditions at a number of locations within the Assessment Area (IDEM 1994). Surficial sediment samples were collected at up to seven sampling stations every two years between 1988 and 1994, including: Dickey Road on IHC; Cline Avenue and Kennedy Avenue on the EBGCR-I; Bridge Street on the EBGCR-II; Indianapolis Boulevard on the WBGCR-I; Hohman Avenue on the WBGCR-II; and, the confluence of the EBGCR and the WBGCR. The concentrations of conventional variables (including TOC), total metals, PAHs, PCBs, pesticides and acid volatile sulfides (AVS) were determined in each of these sediment samples.

Between October 1988 and May 1990, Hoke *et al.* (1993) collected surficial sediment samples from a total of 13 stations within the Assessment Area, including one station each on the WBGCR-I, USC, and IH, two stations each on the WBGCR-II, EBGCR-II, and IHC, and four stations on the EBGCR-I. These investigators measured the concentrations of conventional variables (including TOC), total metals, PAHs, PCBs, pesticides, and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in sediment samples and performed additional analyses for other organic chemicals in pore water samples.

In 1988, the Illinois State Geological Survey conducted an investigation to evaluate the potential environmental impacts associated with dredging activities within the Assessment Area (Risatti and Ross 1989). Sediment samples were collected at a total of 13 sampling stations, of which eight were located in IH/LM, three in the USC, and one in the LGB. The sediment samples were collected using a petite ponar grab sampler and analyzed for total metals, total PCBs, total PAHs, and conventional variables (including TOC). The concentrations of total metals and PCBs in the tissues of four fish species (collected from three locations within the study area) were also determined as part of this study.

As part of a five-year project dealing with the Assessment and Remediation of Contaminated Sediments in the Great Lakes (i.e., the ARCS Program), the Biological Resources Division of USGS conducted a sediment quality evaluation in the Assessment Area during 1989 (USEPA 1996a). In this study, samples were collected at a total of seven locations to assess sediment quality conditions within the Assessment Area, including five stations in the USC and two stations in IH. The chemical analyses that were conducted on the whole sediment samples included conventional variables (including TOC), total metals, PAHs, PCBs, pesticides, butyltins, and polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs). The concentrations of simultaneously extracted metals (SEM) and pore water metals were also determined in this study.

4.2 Data Collected During the Period, 1990 to Present

During the period 1990 to present, IDEM's Tissue Contaminant Monitoring Program represented the primary source of data on the levels of COPCs in edible fish tissues from the Assessment Area. Over this period, fish tissue samples were collected in 1990 (n=3), 1992 (n=4), 1994 (n=18), 1996 (n=24), 1997 (n=3), and 2000 (n=16). The species collected within the Assessment Area during these sampling events included carp (*Cyprinus carpio*), goldfish (*Carassius auratus*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), white sucker *(Catostomus commersoni*), brown trout (*Salmo trutta*), gizzard shad (*Dorosoma cepedianum*), and channel catfish (*Ictalurus punctatus*; Table 5). The tissues (whole body, skin-on fillets, or skin-off fillets) of these fish were analyzed to determine the concentrations of chemical contaminants, including total metals, pesticides, PCBs, acid extractable compounds, base/neutral extractable compounds, and volatile organic compounds (VOCs).

In 1991, U.S. Steel implemented a major study to characterize sediment quality conditions within a portion of the Assessment Area (Floyd-Browne 1993). In this study, a total of 117 sediment samples were collected from 59 sampling stations, with the majority of the sampling effort (35 of 59 stations; 66 sediment samples) conducted on the EBGCR-II between the GCRL culvert (which is located upstream of U.S. Steel permitted outfall 001) to the Industrial Highway (Highway 12) bridge. Another 29 sediment samples were collected from 14 stations on EBGCR-I and three stations (nine samples) were located in the WBGCR-I. Furthermore, 13 sediment samples were collected from seven stations located in the IHC. Three sediment horizons were sampled in this study, including 0 to 7.9 feet (65 samples), 8 to 12.9 feet (42 samples), and 13+ feet (10 samples). The chemical composition of each sediment sample was characterized by measuring the levels of conventional variables (including TOC), total metals, SEM, PAHs, and PCBs.

In November of the same year (1991), the USEPA implemented a sediment quality investigation to further characterize sediment quality conditions in the IH and USC (USEPA 1991). This investigation involved the collection of a total of eight surficial sediment samples from seven locations in IH and a total of 13 samples from 12 locations in the USC. The chemical analyses conducted on these samples included metals, PAHs, and TOC.

To support the development of a Remedial Action Plan for the IH Area of Concern, the USACE conducted an investigation of sediment quality conditions in the Grand Calumet River in 1993 (USACE 1994). While this study was primarily designed to obtain data on the depth of soft, unconsolidated sediments, it also provided information on the concentrations of sediment-associated COPCs in the river system. In total, 18 sediment samples were obtained from four stations located in the USC between Columbus Drive and the junction of the IHC with the LGB. At each station, sediment cores were obtained and used to prepare sediment samples that represented various sediment depths. The concentrations of conventional variables (including TOC), total metals, PCBs, PAHs, and pesticides were determined in each sediment sample.

In the same year (1993), an evaluation of sediment quality conditions was conducted in the WBGCR (Burton 1994; Dorkin 1994). In this study, a total of 61 samples of surficial and sub-surface sediments were collected from seven locations on the WBGCR-II to evaluate sediment chemistry and sediment toxicity. The samples were situated at Roxana Marsh (two stations), Molsberger Place, Columbia Avenue, Sohl Avenue, State Line Avenue, and Torrence Avenue. Chemical characterization of the 61 sediment samples included measurements of conventional variables (including TOC), total metals, and PAHs.

In 1994, the Lake Michigan Ecological Research Station of USGS initiated an investigation of sediment quality conditions in the GCRL (Gillespie *et al.* 1998). As part of this study, 12 surficial sediment samples were collected in the vicinity of an industrial landfill and storage area that contains slag waste and coke piles. The data from sampling stations located in the East and West Lagoons were reported in Gillespie *et al.* 1998, while the data from the sampling stations located in the Little East and Little West Ponds were acquired from the Fully Integrated Environmental Location Decision Support (FIELDS) database, which is administered by USEPA (USDOI 1994). The concentrations of sediment-associated metals and TOC were measured in all of these sediment samples, while the concentrations of selected PAHs were determined in three of the samples.

In 1996, the USACE conducted an investigation to evaluate sediment quality conditions in the GCRL (USACE 1996). In this study, surficial sediment samples were collected from a total of six sampling stations that were located between the western limit of the Lagoon and a site located roughly 1.5 miles to the east. The sampling depth varied among the samples collected, ranging from 0 to 1 feet (grab samples) to 0 to 4 feet (core samples). The concentrations of total metals, PAHs, PCBs, pesticides, VOCs, semi-volatile organic chemicals (SVOCs), and conventional variables (including TOC) were measured in each of the sediment samples.

In 1997, the USEPA initiated an investigation to evaluate sediment quality conditions in the GCRL (Simon 2000). As part of this study, a total of 214 samples were collected to determine the extent of chemical contamination in surficial sediments. A variety of chemical analytes were measured in these samples, including TOC, nutrients, metals, PCBs, pesticides, and various volatile and semi-volatile organic chemicals.

In 1997, IDEM conducted a study to evaluate the chemical characteristics of the tissues of fish from the Grand Calumet River Lagoons (IDEM 2000b). In this study, carp samples were collected from 18 locations the East Lagoon and West Lagoon. Each fish was separated into skin off fillets, the gastrointestinal tract (i.e., organs in body cavity), and body (i.e., head, gills, skin, fins, skeleton with attached flesh) and used to create a composite sample for each location and tissue type. Subsequently, each sample was analyzed for total metals, total PCBs, PAHs, and conventional variables (percent moisture and percent lipids).

Based on the results of a Phase I Site Investigation, a more detailed river sediment investigation was conducted on a portion of the WBGCR-II that is adjacent to the Northern Indiana Public Service Company (NIPSCO) site in 1998 (ThermoRetec 1999). The objectives of this investigation were to further characterize surface water and sediment quality conditions in the vicinity of the former manufactured gas plant, including the distribution of sediment-associated COPCs. As part of this study, four surface water samples, 12 shallow sediment cores (0 to 5 feet deep), and two whole-sediment surface grab samples were collected during the sampling program. The concentrations of various COPCs (i.e., total metals and PAHs) and TOC were measured in the portions of the sediment cores representing 0 to 2 foot, 2 to 4 foot, or 2 to 5 foot depths (i.e., a total of 21 samples) and in the two grab sediment samples.

The USEPA commissioned a study in 1998 to characterize sediments in the vicinity of Roxana Marsh (WBGCR-II; URS Greiner Woodward Clyde 1999). As part of this study, two water samples and nine sediment samples were collected from a total of three sampling stations in the WBGCR. In addition, four water samples and 10 sediment samples were collected at a total of five locations within Roxana Marsh. Conventional variables, nitrogen-ammonia, and total sulfides were measured in pore water samples. Sediment sampling consisted of the collection of both surficial grab samples and sediment cores, with chemical analyses including conventional variables (including TOC), total metals, PCBs, PAHs, and pesticides.

In the same year (1998), a study was initiated by DuPont to evaluate sediment quality conditions on EBGCR-I (Exponent 1999). Sediment samples were collected from 33 stations on the EBGCR-I and six stations in nearby wetland areas, primarily in the vicinity of DuPont's East Chicago facility (which is adjacent to the EBGCR and IHC confluence). Both surficial grab samples (68 samples) and core samples (25 samples, to a maximum depth of 15 feet) were collected from the EBGCR-I during this investigation. All six of the wetland samples collected were surficial grabs. Chemical characterization of the sediment samples included measuring conventional variables (including TOC), VOCs, total metals, SEM, AVS, PAHs, PCBs, and pesticides.

In early 1999, the IDEM commissioned the USACE to characterize the chemical composition of surficial and sub-surface sediments throughout the Assessment Area (Maxim Technologies 1999). In total, 103 samples from 43 stations were collected and analyzed from transects established on EBGCR-I (60 samples), IHC (10 samples), LGB (18 samples), WBGCR-I (nine samples), and GCRL (five samples). Another 24 samples were collected from 18 wetland stations that were located in the vicinity of EBGCR-I (10 samples), IHC (one sample), and LGB (13 samples). Cores were taken from the right, center, and left bank of the river at each of the 14 transects that were established; a single core was taken at another sampling location. Samples from these cores were taken from the surface layer (0 to 5 feet) and from one to three additional horizons (to a maximum of 15 feet). In addition, surficial sediment grabs were collected from another 16 locations. Each sediment sample was analyzed for total metals, SEM, AVS, PAHs, PCBs, VOCs, pesticides, TOC, and oil/grease.

5.0 Assessment of Injury to Human Uses of Fishery Resources

This investigation was conducted to determine if biological resources within the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, Indiana Harbor and the nearshore areas of Lake Michigan (i.e., the Assessment Area) have been injured due to discharges of oil or releases of other hazardous substances, as defined in 43 CFR § 11.62(f)(1)(ii and iii) in the USDOI regulations for conducting NRDAs (CFR 2002). In this report, the term injury to human uses of fishery resources has been used to more specifically describe such injuries to biological resources. Under the USDOI regulations for conducting NRDAs (CFR 2002), an injury to a biological resource has resulted from the "... release of a hazardous substance if the concentration of the substance is sufficient to ...

- Exceed action or tolerance levels established under Section 402 of the Food, Drug, and Cosmetic Act, 21 U.S.C. 342, in edible portions of organisms [43 CFR § 11.62(f)(1)(ii)]; or,
- Exceed levels for which an appropriate State health agency has issued directives to limit or ban consumption of such organisms [43 CFR § 11.62(f)(1)(iii)]."

In this investigation, the definitions of injury to biological resources included in the USDOI regulations were generally applied to support the assessment of the effects of chemical contamination on human use and consumption of fish and shellfish (i.e., injury to human uses of fishery resources). Injury to human uses of fishery resources was assessed for each of the geographic areas (i.e., the GCR/IHC, GCRL, and IH/LM). Three separate lines of evidence were used to determine if injury to human uses of fishery resources has occurred. More specifically, injury to human uses of fishery resources was considered to have occurred in an area if:

- The concentrations of one or more COPCs in two or more whole sediment samples (separated by more than 100 feet) exceeded the selected chemical benchmarks for the protection of human health;

- The concentrations of one or more COPCs in one or more fish tissue samples exceeded the selected chemical benchmarks for the protection of human health (i.e., the tolerance levels or action levels established by the USFDA or the Group 1 thresholds that have been used by the State of Indiana to establish FCAs); or,

- FCAs have been issued for one or more species of fish.

The following sections of this document present the results of the assessment that was conducted to assess injury to human uses of fishery resources in GCR/IHC, GCRL, and IH/LM.

5.1 Evaluation of Injury to Human Uses of Fishery Resources Based on Exceedances of Benchmarks for Sediment Chemistry

In this report, sediment chemistry data were used in conjunction with selected benchmarks for sediment chemistry to assess injury to human uses of fishery resources in the Assessment Area. More specifically, the concentrations of COPCs in each whole sediment sample were compared to the corresponding sediment chemistry benchmark for the protection of human health (i.e., the organic carbon-normalized SQC that were promulgated by the WSDOH (1995; 1996). These SQCs represent the concentrations of sediment-associated COPCs which do not pose a significant threat to human health (WSDOH 1995). The presence of one or more COPCs in two or more samples (separated by 100 feet) at concentrations in excess of the selected benchmarks for sediment chemistry was considered to provide the necessary and sufficient evidence to demonstrate the presence of conditions sufficient to cause or substantially contribute to injury to human uses of fishery resources in a geographic area.

Grand Calumet River/Indiana Harbor Canal - Information on the concentrations of COPCs (and associated measurements of TOC levels) was compiled for 579 whole sediment samples collected within the GCR/IHC between 1980 and present. Of these, 361 samples provide information on the levels of COPCs in surficial sediment samples (Table 6), while 218 samples provide data on COPC concentrations in sub-surface sediment samples (Table 7). Although additional data on sediment quality conditions were compiled in the project database (see MacDonald and Ingersoll 2000), only those samples for which matching information was available on the concentrations of COPCs and on levels of total organic carbon (TOC) were used to evaluate injury to human uses of fishery resources.

The results of this evaluation indicate that a number of COPCs occur in sediments from the Grand Calumet River and Indiana Harbor Canal at concentrations sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. More specifically, there were exceedances of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of high molecular weight PAHs [i.e., benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno(1,2,3-cd)pyrene] were measured (i.e., n=80 to 244 for surficial samples and n=43 to 127 for sub-surface samples; Tables 6 and 7). In addition, there were exceedances of the selected benchmarks in all of the samples from the GCR/IHC in which the concentrations of total PCBs were measured [i.e., 1.7 :g/kg organic carbon (OC); n=154 for surficial samples and n=52 for sub-surface samples; Tables 6 and 7]. The absence of applicable benchmarks for sediment-associated metals precluded an evaluation of the hazards posed by these substances to human health. The levels of certain pesticides [i.e., chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, beta-hexachlorocyclohexane (beta- HCH), lindane, and DDTs], TCDD-TEQs, and various other substances (i.e., benzene and carbazole) also exceeded the human health-based benchmarks for sediment chemistry in all or a portion of the whole sediment samples from this portion of the Assessment Area (Tables 6 and 7). Therefore, it is concluded that concentrations of PAHs, PCBs, and other bioaccumulative substances occur in sediments from the GCR/IHC at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, and certain other chlorophenols, PAHs, and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Grand Calumet River Lagoons - Data are available on the concentrations of COPCs and TOC for 222 whole sediment samples collected within the GCRL. All of these samples were collected during the period between 1995 and 1999. Of these, 202 samples provide information on the levels of COPCs in surficial sediment samples (Table 6), while 20 samples provide data on COPC concentrations in sub-surface sediment samples (Table 7). Only the data for those samples for which matching information was available on the concentrations of COPCs and on levels of TOC were used to evaluate injury to human uses of fishery resources.

Comparison of the measured levels of COPCs in whole sediment samples with the benchmarks for sediment chemistry indicate that a number of COPCs occur in GCRL sediments at concentrations sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. More specifically, the concentrations of benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno(1,2,3-cd)pyrene in whole sediment samples from the GCRL always exceeded the levels that have been established to protect human health (n=4 to 127 for surficial sediment samples and n=1 to 2 for sub-surface sediment samples; Tables 6 and 7). Likewise, the levels of total PCBs and various PCB mixtures (e.g., Aroclor 1254) exceeded the benchmarks for sediment chemistry in all of the surficial sediment samples from the GCRL in which these substances were measured (n=4 to 29; Table 6). The concentrations of total PCBs and various PCB mixtures were not measured in any of the sub-surface sediment samples from the GCRL. As applicable benchmarks for sediment-associated metals were not located in the literature, it was not possible to evaluate the hazards to human health posed by these substances. The levels of certain pesticides (i.e., chlordane, dieldrin, endrin, and DDTs) also exceeded the human health-based benchmarks for sediment chemistry in all or a portion of the surficial sediment samples from the GCRL (Tables 6 and 7). Therefore, it is concluded that concentrations of PAHs, PCBs, and other bioaccumulative substances occur in GCRL sediments at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, chlorophenols, TCDD-TEQs, and certain other PAHs and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Indiana Harbor and the Nearshore Areas of Lake Michigan - Fewer data are available on sediment quality conditions in IH/LM than are available for the other two geographic areas of the Assessment Area. In total, data on the concentrations of COPCs in surficial sediments (with associated measurements of TOC levels) were compiled for 53 whole sediment samples collected within IH/LM (Table 6). All of these samples were collected between 1987 and 1991. No data were located on the chemical composition of sub-surface sediment samples. Only those samples for which matching information was available on the concentrations of COPCs and on levels of TOC were considered in the evaluation of injury to human uses of fishery resources.

The results of this evaluation indicate that surficial sediments from IH/LM have concentrations of several COPCs that are sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. More specifically, there were exceedances of the selected benchmarks for the protection of human health in all of the samples from IH/LM in which the concentrations of six high molecular weight PAHs were measured (n=6 to 10; Table 6). In addition, all of the surficial sediment samples from IH/LM for which total PCBs were measured (n=30) had concentrations of total PCBs that exceeded the selected benchmarks for sediment chemistry (i.e., 1.7 : g/kg OC). The benchmarks for various PCB mixtures were consistently exceeded in whole sediment samples from this portion of the Assessment Area (Table 6). The absence of applicable benchmarks for sediment-associated metals precluded an evaluation of the hazards posed by these substances to human health. The levels of certain pesticides (i.e., chlordane, dieldrin, and DDE) and TCDD-TEQs also exceeded the human health-based benchmarks for sediment chemistry in all of the whole sediment samples for which data are available (Table 6). Therefore, it is concluded that concentrations of PAHs, PCBs, and other bioaccumulative substances occur in sediments from IH/LM at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, chlorophenols, and certain other PAHs and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

5.2 Evaluation of Injury to Human Uses of Fishery Resources Based on Exceedances of Benchmarks for Tissue Chemistry

In this report, data on the levels of COPCs in fish tissues were used in conjunction with selected benchmarks for tissue chemistry to assess injury to human uses of fishery resources in the Assessment Area. That is, the concentrations of COPCs in each fish tissue sample were compared to the corresponding benchmarks for the protection of human health. Two sets of benchmarks for tissue chemistry were considered in this assessment, including the action levels or tolerance levels established by the USFDA (2001) and the thresholds that were established by the ISDH for developing the Indiana FCA (Stahl and Simon 2000). The USFDA action levels or tolerance levels represent the concentrations of tissue-associated COPCs that are considered to be safe for human consumption and apply to fish and shellfish caught in commercial fisheries and offered for sale outside the state of origin (i.e., interstate commerce). By comparison, the thresholds that have been established by ISDH identify the concentrations of tissue-associated COPCs that are used for classifying fish species of various sizes into advisory groups based on the maximum recommended frequency of consumption (ISDH, IDEM, and IDNR 2002). The occurrence of one or more COPCs in one or more samples at concentrations in excess of the selected benchmarks for tissue chemistry (i.e., the tolerance levels or action levels that have been promulgated by the

USFDA **or** the Group 1 threshold levels that have been established by the ISDH to support the development of FCAs) was considered to provide the necessary and sufficient evidence to demonstrate the presence of conditions sufficient to cause or substantially contribute to injury to human uses of fishery resources in a geographic area.

Grand Calumet River/Indiana Harbor Canal - Information on the concentrations of COPCs in fish tissues was compiled for 91 samples collected within the GCR/IHC between 1980 and 2000. These samples were analyzed to provide data on the levels of PCBs, pesticides, metals, and conventional variables (e.g., percent lipid, percent moisture) in a total of seven fish species, including carp, pumkinseed, sunfish (species unspecified), goldfish, white sucker, channel catfish, and gizzard shad.

The USFDA has established action levels or tolerance levels for six of the COPCs that occur in the Assessment Area, including methylmercury, PCBs, aldrin/dieldrin, chlordane, DDTs (i.e., DDD, DDE, and DDT), and heptachlor/heptachlor epoxide. These benchmarks for tissue chemistry apply specifically to the edible portions of fish and shellfish. The results of this evaluation indicate that the concentrations of mercury, aldrin, dieldrin, sum DDD, sum DDE, and sum DDT, total DDTs, heptachlor, and heptachlor epoxide never exceeded the USFDA action levels in fish tissue samples from the GCR/IHC (Tables 8 to 20). The action level for chlordane was exceeded in one sample of carp tissue collected in 1982 (Table 19). Therefore, mercury and organochlorine pesticides rarely occurred in fish tissues at concentrations of concern relative to the protection of human health (i.e., levels that would affect the sale of fish or fish products outside Indiana).

In contrast to the other substances considered, the accumulation of PCBs in fish utilizing habitats in the GCR/IHC represents a potential risk to human health. Of the 87 fish tissue samples in which total PCBs was measured, 70 (83%) had concentrations that exceeded the tolerance levels that have been established by the USFDA (Table 20). Among the fish species tested, channel catfish had the highest frequency of exceedance of the USFDA tolerance levels (i.e., 100%; n=1). The frequency of exceedance of the USFDA tolerance levels was also high for carp (86%; n=64) and goldfish (81%; n=16). The frequency of exceedance was lower in white sucker (33%; n=3), gizzard shad (0%;

n=2), and sunfish (0%; n=1; Table 20). Therefore, based on the frequency of exceedances of the USFDA tolerance level for PCBs and the USFDA action level for chlordane, it is concluded that conditions sufficient to injure human uses of fishery resources occur in the GCR/IHC. The available tissue residue data indicate that such conditions have been consistently observed between 1982 and 2000.

Although the USFDA action levels and tolerance levels provide important tools for evaluating fish and shellfish tissue quality (especially for fish and shellfish that are caught and sold commercially), the ISDH Group 1 advisory provide more relevant benchmarks for assessing the quality of sport-caught fish species in Indiana (Anderson *et al.* 1993; i.e., 0.16 mg/kg WW for mercury and 50 :g/kg WW for total PCBs in skin-on scaleless fillets; Stahl and Simon 2000). Comparison of the measured concentrations of mercury and total PCBs to the thresholds used to establish FCAs in Indiana indicates that the accumulation of COPCs in fish tissues poses a human health concern in the GCR/IHC. Data on the concentrations of mercury in edible tissues are available for seven species of fish from the GCR/IHC (n=86 samples). Overall, these results show that most of the fish collected from the GCR/IHC had <0.16 mg/kg WW of mercury in their tissues (i.e., 93%; 80 of 86 samples; Table 21). The Group 1 threshold concentration was never exceeded in the tissues samples obtained from channel catfish, gizzard shad, goldfish, pumpkinseed, sunfish, or white suckers (Table 21). However, 6 of the 62 tissue samples (10%) obtained from carp had concentrations of mercury sufficient to injure human uses of fishery resources. These samples were collected in 1986 and 1996 (Table 21).

A total of 87 fish samples were collected and analyzed between 1980 and 2000 to determine the concentrations of total PCBs in edible fish tissues from the GCR/IHC. Collectively these data indicate that total PCBs were always measured at concentrations that pose unacceptable risks to human health (i.e., >50 :g/kg WW). The majority of these samples (i.e., 83%; 72 of 87) had total PCB concentrations in excess of the Group 5 threshold (i.e., 1900 :g/kg WW for skin-on scaleless fillets; no consumption of such fish is recommended; Table 22). Among the species tested, channel catfish, carp, and goldfish had the highest frequency of exceedance of the Group 5 threshold (100%; n=1 and 88%; 56 of 64 samples and 14 of 16 samples, respectively; Table 22). Therefore, the levels of total PCBs in fish tissues collected from the GCR/IHC were sufficient to injure human uses of fishery resources in all of the species tested between 1980 and 2000.

Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs frequently occurred at concentrations sufficient to injure human uses of fishery resources in the GCR/IHC. Organochlorine pesticides in the edible tissues of fish only rarely posed a potential risk to human health, based on comparisons to the USFDA action levels. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Grand Calumet River Lagoons - Information on the concentrations of COPCs in fish tissues was compiled for 25 samples collected within the GCRL during 1986 and 1997. These samples were analyzed to provide data on the levels of PCBs, pesticides, metals, and conventional variables (e.g., percent lipid, percent moisture) in a total of three fish species, including carp, largemouth bass, and bluegill. The concentrations of mercury, PCBs, aldrin/dieldrin, chlordane, DDTs (i.e., DDD, DDE, and DDT), and heptachlor/heptachlor epoxide were compared to the USFDA action levels or tolerance levels to assess injury to human uses of fishery resources. In addition, the ISDH Group 1 thresholds for mercury and total PCBs were used to determine if the concentrations of these substances in fish tissues were sufficient to injure human uses of fishery resources.

Evaluation of the available data on the concentrations of COPCs in fish tissues from the GCRL indicates that the USFDA action levels or tolerance levels were not exceeded in any of the species tested (Tables 23 to 35). Therefore, the concentrations of mercury, PCBs, aldrin/dieldrin, chlordane, DDTs (i.e., DDD, DDE, and DDT), and heptachlor/heptachlor epoxide in the edible tissues of fish (caught in a commercial fishery and offered for sale outside Indiana) from this portion of the Assessment Area are not considered to pose a human health concern (i.e., based on the frequency of exceedance of the USFDA action levels or tolerance levels).

Although the USFDA action levels and tolerance levels provide important tools for evaluating fish and shellfish tissue quality (especially for fish and shellfish that are caught and sold commercially), the ISDH Group 1 advisory provide more relevant benchmarks for assessing the quality of sport-caught fish species in Indiana (Anderson *et al.* 1993; i.e., 0.16 mg/kg WW for mercury and 50 : g/kg WW for total PCBs in skin-on scaleless fillets; Stahl and Simon 2000). Comparison of the measured concentrations of mercury and total PCBs to the thresholds used to establish FCAs in Indiana indicates that the accumulation of COPCs in fish tissues poses a human health concern in the GCRL. For mercury, 18 of 21 fish tissue samples (86%) had concentrations less than 0.16 mg/kg WW; however, three of the 14 carp samples collected in 1997 had mercury concentrations in excess of the Group 1 threshold (Table 36). In addition, all of the fish tissue samples (n=1 for bluegill, n=21 for carp, and n=3 for largemouth bass) collected in 1986 and in 1997 had concentrations of total PCBs in excess of the Group 1 threshold (Table 37). The levels of total PCBs in most of these tissue samples (i.e., 92%; 23 of 25) were sufficient to warrant a recommendation that sensitive components of the human population not consume these fish (i.e., the Group 3 or Group 4 thresholds were exceeded; Table 37).

Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs frequently occurred at concentrations sufficient to injure human uses of fishery resources in the GCRL. Organochlorine pesticides in the edible tissues of fish did not pose a potential risk to human health, based on comparisons to the USFDA action levels. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Indiana Harbor and the Nearshore Areas of Lake Michigan - Information on the concentrations of COPCs in fish tissues was compiled for 22 samples collected in IH/LM during 1988 and 1996. These samples were analyzed to provide data on the levels of PCBs, pesticides, metals, and conventional variables (e.g., percent lipid, percent moisture) in a total of six fish species, including brown trout, carp, gizzard shad, longnose sucker, sunfish (species unspecified), and yellow perch. The concentrations of mercury, PCBs, aldrin/dieldrin, chlordane, DDTs (i.e., DDD, DDE, and DDT), and heptachlor/heptachlor epoxide were compared to the USFDA action levels or tolerance levels to assess injury to human uses of fishery resources. In addition, the ISDH Group 1 advisory thresholds for mercury and total PCBs were used to determine if the concentrations of these substances in fish tissues were sufficient to injure human uses of fishery resources.

Evaluation of the available data on the concentrations of COPCs in fish tissues indicates that the USFDA action levels or tolerance levels were only infrequently exceeded in fish collected from IH/LM (Tables 38 to 50). More specifically, the concentrations of mercury, aldrin/dieldrin, chlordane, DDTs (i.e., DDD, DDE, and DDT), and heptachlor/heptachlor epoxide in edible fish tissues from this portion of the Assessment Area did not exceed the USFDA action levels in any of the samples tested during 1988 or 1996. Therefore, these substances are not considered to pose a human health concern in IH/LM (i.e., if these fish were caught in a commercial fishery and offered for sale outside Indiana). However, 11% (i.e., 2 of 18 samples) collected in 1988 and 50% (i.e., 2 of 4 samples) collected in 1996 had levels of total PCBs in excess of the USFDA tolerance level (2000 :g/kg WW; Table 50). The levels of total PCBs in the edible tissues of both carp (3 of 6 samples) and gizzard shad (1 of 8 samples) were sufficient to injure human uses of fishery resources in IH/LM (Table 50).

Although the USFDA action levels and tolerance levels provide important tools for evaluating fish and shellfish tissue quality (especially for fish and shellfish that are caught and sold commercially), the ISDH Group 1 advisory thresholds provide more relevant benchmarks for assessing the quality of sport-caught fish species in Indiana (Anderson *et al.* 1993; i.e., 0.16 mg/kg WW for mercury and 50 :g/kg WW for total PCBs in skin-on scaleless fillets; Stahl and Simon 2000). Comparison of the measured concentrations of mercury and total PCBs in fish tissue samples to the thresholds used to establish FCAs in Indiana indicates that the accumulation of both of these COPCs in fish tissues poses a human health concern in the IH/LM. More specifically, 19% (4 of 21) of the fish tissue samples collected from IH/LM had mercury concentrations in excess of 0.16 mg/kg WW (Table 51). For carp and longnose sucker, 50% of the tissue samples collected from IH/LM (i.e., 3 of 6 for carp and 1 of 2 for longnose sucker) had elevated concentrations of mercury (i.e., relative to the ISDH Group 1 advisory threshold; Table 51). The measured concentrations of mercury in brown trout, gizzard shad, sunfish, and yellow perch were all below the ISDH Group 1 advisory threshold (Table 51).

The levels of total PCBs in the tissues of fish from IH/LM also pose a potential risk to human health. Of the 22 fish tissue samples included in the project database, 86%;19 of 22) had total PCB concentrations in excess of the ISDH Group 1 advisory threshold (Table 52). For brown trout (n=2), carp (n=6), gizzard shad (n=8), and sunfish (n=1), all of the samples collected from this portion of the Assessment Area had levels of total PCBs sufficient to injure human uses of fishery resources (Table 52). The frequency of exceedance of the ISDH Group 1 advisory threshold was lower for longnose sucker (i.e., 50%; n=2) and yellow perch (i.e., 33%; n=3; Table 52). The majority of these samples (i.e., 86%; 19 of 22) had total PCB concentrations in excess of the Group 2 threshold (i.e., 60 :g/kg WW for skin-on scaleless fillets; consumption restrictions are recommended for such fish; Table 52).

Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs frequently occurred at concentrations sufficient to injure human uses of fishery resources in the IH/LM. However, organochlorine pesticides in the edible tissues of fish did not pose a potential risk to human health, based on comparisons to the USFDA action levels. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

5.3 Evaluation of Injury to Human Uses of Fishery Resources Based on the Issuance of Fish Consumption Advisories

Under the regulations that have been promulgated by the USDOI, biological resources have been injured if edible fish and/or shellfish tissues contain concentrations of a hazardous substance sufficient to exceed levels for which an appropriate state health agency has issued directives to limit or ban the consumption of such tissues [43 CFR § 11.62 (f)(1)(iii); CFR 2002]. Injuries pursuant to this injury definition were determined by summarizing the FCAs that have been issued by the State of Indiana for the Grand Calumet River and Indiana Harbor Canal in Lake County, the Grand Calumet River Lagoons, and by the four states bordering Lake Michigan (i.e., Illinois, Indiana, Wisconsin, and Michigan) for the lake. This section of this report provides an overview of the FCA program that has been established in Indiana, describes the thresholds that have been used to set FCAs in Indiana, and presents a list of FCAs that have been issued by the State of Indiana since 1972 (ISDH, IDEM, and IDNR 2002).

5.3.1 Overview of Indiana's Fish Consumption Advisory Program

In response to concerns regarding the levels of COPCs in the tissues of fish and other aquatic organisms, the IDNR initiated a program (which is now referred to as the Tissue Contaminant Monitoring Program) in 1972 to sample and analyze fish tissues to assess the levels of bioaccumulative substances. Based on the results of this program and the advice that had been disseminated to the public in the other states bordering Lake Michigan, in 1977 the Indiana State Board of Health (ISBH) recommended that consumption of lake trout from Lake Michigan be restricted due to the presence of elevated levels of COPCs in the tissues of this species (Table 53).

In 1985, a number of important developments occurred that substantially advanced the FCA program in Indiana (Table 53). First, the four states bordering Lake Michigan agreed to share and pool their analytical data on the levels of COPCs in fish tissues. This development provided each state with a more comprehensive understanding of the levels of COPCs in fish from Lake Michigan and, hence, a more defensible basis for issuing FCAs. In addition, the

FCA system was refined to facilitate classification of fish into three advisory groups (i.e., Group 1, 2, and 3), based on the recommended frequency of consumption for various segments of the human population (i.e., general population vs. sensitive population). Fish were classified into these groups according to the proportion of samples that had COPC concentrations in excess of USFDA tolerance levels or action levels (Table 54). More specifically, Group 1 fish included those species and/or size classes for which one or more USFDA tolerance levels or action levels were exceeded in fewer than 10% of the samples tested; consumption of Group 1 fish was considered to pose the lowest risk among the three groups and, hence, consumption was not restricted. If 50 to 90% of the fish tissue samples had concentrations of one or more COPCs in excess of the USFDA tolerance levels or action levels, then those species and/or size classes were classified into Group 2; consumption of Group 2 fish was restricted to one meal per week for the general population (preparation and cooking instructions were also provided to reduce exposure to COPCs), while the sensitive population (i.e., pregnant women, breast-feeding women, women planning to have children, and children under the age of 15) was advised to not eat these fish. Group 3 fish included those species and/or size classes for which one or more of the USFDA tolerance levels or action levels were exceeded in 90% or more of the samples tested; all segments of the human population were advised to not eat these fish. No advisory group was assigned to species and/or age classes for which 10 to 50% of the samples tested had one or more exceedances of the USFDA tolerance levels or action levels.

Although the four states bordering Lake Michigan had worked cooperatively on issues related to FCAs since the early 1980's, a broader plan was initiated in 1986 to provide consistent advice regarding the consumption of Great Lakes fish, as part of the Great Lakes Governor's Toxics Agreement (Table 53). More specifically, the Great Lakes Sport Fish Consumption Advisory Task Force (Task Force) was formally established to facilitate the sharing of information and coordinate FCAs throughout the Great Lakes basin. As part of this effort, the Task Force was charged with the responsibility of developing a uniform sport FCA protocol applicable to all of the Great Lakes. The protocol was intended to maintain the health benefits associated with fish consumption; minimize the potential for angler exposure to toxic substances; utilize credible and understandable science; and, present the information in a manner conducive to maximal voluntary compliance.

To facilitate the development of a defensible protocol for developing FCAs, the Task Force conducted an in-depth review of the procedures that had been used previously to establish FCAs. The results of this review indicated that the USFDA action levels and tolerance levels, that had been promulgated primarily for assessing the levels of COPCs in commercially-caught fish and shellfish, were not adequately protective of human health, particularly for those individuals who consumed sport-caught fish (i.e., anglers and subsistence fishers tended to have higher daily intake rates of fish and shellfish than was assumed in the development of the USFDA action levels). For this reason, the Task Force re-evaluated the available toxicological data for key COPCs (e.g., PCBs and mercury) to establish human HPVs that identified tolerable daily intake rates for certain toxic substances (i.e., initially for PCBs and later for mercury). In turn, the HPVs were used in conjunction with information on daily fish consumption rates, human body weights, and losses of COPCs during preparation and cooking to establish thresholds for grouping fish species and/or size classes into five advisory groups (i.e., Groups 1 to 5). These advisory groupings provide consumers with information on the recommended frequency of consumption of Indiana sport-caught fish, including:

- Group 1 - Unlimited consumption for adult males and females (restrict consumption to one meal per week for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15);
- Group 2 - Restrict consumption to one meal per week for adult males and females (restrict consumption to one meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15);
- Group 3 - Restrict consumption to one meal per month for adult males and females (for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15, do not eat);
- Group 4 - Restrict consumption to one meal every two months for adult males and females (for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15, do not eat); and,
- Group 5 - No consumption (do not eat).

This risk-based approach recognizes that the adverse effects associated with the consumption of contaminated tissues of fish result from the accumulation of COPCs in humans over extended time periods. Accordingly, the resultant FCAs are designed to provide the highest level of protection to those segments of the human population that are most sensitive to the effects of tissue-borne COPCs.

5.3.2 Tissue Residue Benchmarks for Establishing Fish Consumption Advisories

In general, FCAs are developed by evaluating data on the levels of COPCs in the tissues of fish relative to tissue residue benchmarks. Such benchmarks identify tolerable levels of COPCs in the tissues of fish and other aquatic organisms relative to the protection of human health. Benchmarks for tissue chemistry are typically derived by first determining the tolerable daily intake (TDI) rate of a COPC (i.e., in mg/kg body weight (BW)/day), based on an evaluation of the available data on the toxicity of the COPC to mammalian receptors. Subsequently, the TDI is used in conjunction with information or assumptions regarding the body weight of the target receptor group (e.g., general population), the daily intake rate of fish and other aquatic organisms, and reductions in the concentrations of COPCs during food preparation and cooking to establish the tolerable levels of bioaccumulative COPCs in the tissues of fish and other aquatic organisms. The action levels and tolerance levels for methylmercury, PCBs, aldrin/dieldrin, chlordane, DDTs (i.e., DDD, DDE, and DDT), and heptachlor/heptachlor epoxide that have been established by the USFDA are presented in Table 3. The thresholds that have been adopted by the ISDH for mercury and total PCBs to support the development of the Indiana FCA are presented in Table 4.

5.3.3 Fish Consumption Advisories in the Assessment Area

In Indiana, responsibility for issuing FCAs is vested in ISDH, IDEM, and IDNR. Each year, representatives from these three agencies meet to discuss the recent fish monitoring data and to develop the new statewide FCA (e.g., ISDH, IDEM, and IDNR 2002). Such FCAs are developed using risk-based procedures that consider the segment of the population that may be adversely affected by consuming fish tissues (e.g, adult males, women planning to have children, pregnant or breast-feeding women, and children), the duration of exposure to tissue-associated COPCs, source of the fish (i.e., water body), and the levels of COPCs in the tissues of fish of various species and/or sizes. Between 1985 and 1994, fish of various species and sizes were classified into one of three categorical groups based on the frequency of exceedance of the USFDA action levels or tolerance levels (Table 54). Since 1995, fish of various species and sizes have been classified into five categorical groups based on comparisons of the measured concentrations of mercury and PCBs to the thresholds that were adopted by ISDH (Table 54). In this investigation, the issuance of Group 2, 3, 4, or 5 FCAs on one or more fish species (and/or size classes) was considered to provide the necessary and sufficient evidence of an injury to human uses of fishery resources within the Assessment Area.

Grand Calumet River and Indiana Harbor Canal - In 1986, the ISBH (which is now referred to as the ISDH) classified the GCR/IHC (including the WBGCR, EBGCR downstream of the GCRL, IHC, LGB, and IH) as a Group 3 waterway. Accordingly, the public was advised to not eat any fish caught in these waters because of the high levels of contamination in fish tissues (Table 55). The FCA was re-issued in 1989; however, the geographic scope of the waters covered under the advisory was narrowed to included WBGCR, EBGCR, and IHC only (i.e., LGB and IH were excluded from the FCA that applied to GCR/IHC). This revised FCA was re-issued each year between 1990 and 1994 (Table 55). Although ISDH did not issue a FCA for GCR/IHC in either 1995 or 1996, the 1994 FCA was considered to remain in effect during 1995 and 1996 for the purpose of this assessment because it was not revoked and because examination of the underlying tissue residue data revealed no pattern of decreasing concentrations of mercury or PCBs during or immediately prior to this period. Between 1997 and 2002, the GCR/IHC was classified as a Group 5 waterway each year and the associated FCA was issued to the public (Table 55). Therefore, ISDH and its partners have issued FCAs for all species of fish from the GCR/IHC for 13 of the years between 1986 and 2002. Unless the FCA was explicitly revoked, it is reasonable to assume that these FCAs also applied to years when FCA were not issued by ISDH. Therefore, it is concluded that human uses of fishery resources in the GCR/IHC were injured as a result of the accumulation of mercury and PCBs during the period 1986 to 2002 (Tables 56 and 57).

Grand Calumet River Lagoons - In 1996, the ISDH issued a FCA for the GCRL (which are referred to as the Marquette Park Lagoons in the Indiana FCA. This FCA recommended that adult males and females consume no more than one meal per month of largemouth bass greater than 12 inches in length or carp between 15 and 20 inches in length (Table 58). The sensitive population (i.e., women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old) was advised to not eat these fish. At the same time, adult males and females were advised to limit their consumption of carp between 20 and 25 inches in length to no more than one meal every two months. It was further recommended that these fish should not be eaten by women who were planning to have children, pregnant, or breast-feeding or by children under the age of 15 years old (i.e., the sensitive population). The FCA also recommended that carp greater than 25 inches in length from the GCRL not be eaten by anyone. The 1996 FCA for largemouth bass and carp was re-issued in the Indiana FCA each year between 1997 and 2002 (Tables 57 and 58).

In 1999, the ISDH also issued a FCA on bluegills (Table 58). More specifically, it was recommended that adult males and females consume no more than one meal per month of bluegills between four and seven inches in length. The sensitive population was advised to not eat these fish. At the same time, adult males and females were advised to limit their consumption of bluegills greater than seven inches in length to no more than one meal every two months, and the sensitive population was advised that these fish should not be eaten. Therefore, it is concluded that human uses of fishery resources in the GCRL were injured as a result of the accumulation of PCBs during the period 1996 to 2002 (Tables 56 and 57).

Indiana Harbor and the Nearshore Areas of Lake Michigan - While sampling to evaluate the levels of bioaccumulative substance in fish tissues was initiated in 1972, the first FCA for Lake Michigan was not issued until 1977 (L. Bridges. IDEM. Indianapolis, Indiana. Personal communication; Table 53). At that time, the ISBH advised all segments of the human population to not eat lake trout (*Salvelinus namaycush*) from Lake Michigan due to the presence of elevated levels of bioaccumulative substances in their tissues. In 1983, this FCA was expanded to include three other salmonid species, including all size classes of brown trout (*Salmo trutta*), coho salmon (*Oncoryhnchus kisutch*), and steelhead trout (*Oncoryhnchus mykiss*). More specifically, it was recommended that adult males and females consume no more than one meal per week of these three salmonid species. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat these fish (Tables 57 and 59).

In 1985, the four states bordering Lake Michigan (i.e., Illinois, Indiana, Michigan, and Wisconsin) agreed to share and pool their data on the levels of COPCs in fish from Lake Michigan. In addition, the FCA classification system was refined to consider the length of the fish species under consideration and to more formally adopt a three tiered system for grouping fish based on the consumption recommendations (Table 53). Based on the information contained in the enhanced database, consumers in Indiana were advised to refrain from consuming any brown trout, carp, and lake trout from Lake Michigan greater that 25 inches in length (ISBH 1985a). This FCA was re-issued in 1986 (ISBH 1986; Tables 57 and 59).

In 1987, the four states bordering Lake Michigan issued the first joint FCA that applied to all of the fish caught in the Lake Michigan recreational fishery (Table 53). More specifically, Illinois, Indiana, Michigan, and Wisconsin indicated that no segment of the human population should eat the following fish from Lake Michigan: carp of any size; catfish of any size; brown trout greater than 23 inches in length; chinook salmon greater than 32 inches in length; or lake trout greater than 23 inches in length (Table 59). These states further recommended that adult males and females consume no more than one meal per week of brown trout up to 23 inches, chinook salmon between 21- 32 inches, coho salmon greater than 26 inches, or lake trout up to between 20- 23 inches from Lake Michigan. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat these fish (Tables 57 and 59). The FCA was expanded to include the tributaries to Lake Michigan in 1990 and subsequently remained in effect until 1994. In all cases, these FCAs were established based on exceedances of the action levels or tolerance levels that were established by the USFDA.

In 1995, a number of refinements to the FCA system were implemented to provide the public with more precise advice regarding the consumption of sport-caught fish from

Lake Michigan and associated tributaries (Table 53). Importantly, the protocol for developing a uniform Great Lakes sport FCA (that was completed in 1993; Anderson *et al.* 1993) was adopted by Indiana for assessing the risks to human health associated with the consumption of PCB-contaminated fish (Table 53). Accordingly, the categorical grouping for spacing Indiana sport-caught fish meals was expanded from the three group system that was used between 1985 and 1994 to the five group system that has been used since 1995 (Table 53). This expanded system provided the public with a basis for making more informed choices regarding the consumption of fish from Lake Michigan and its tributaries.

Using the most recent data on the concentrations of COPCs in fish tissues and the new protocol, the ISDH and its partners issued a number of FCAs in 1995 for Lake Michigan and associated tributaries (Table 59). More specifically, it was recommended that consumers not eat carp (*Cyprinus carpio*) of any size, blue suckers (*Cycleptus elongatus*), carpsuckers (*Carpoides velifer*), longnose suckers (*Catostomus catostomus*), spotted suckers (*Minytrema melanops*), or white suckers (*Catostomus commersoni*) of 15 to 23 inches in length, channel catfish (*Ictalurus punctatus*) of 13 or more inches in length, brown trout (*Salmo trutta*) greater than 27 inches in length, or lake trout (*Salvelinus namaycush*) greater than 26 inches in length. It was further recommended that adult males and females limit consumption of the following fish to one meal every two months: blue suckers, carpsuckers, longnose suckers, spotted suckers, or white suckers of 8 to 15 inches in length, walleye (*Stizostedion vitreum*) greater than 26 inches in length, brown trout (*Salmo trutta*) of 18 to 27 inches in length, chinook salmon (*Oncorhynchus tschawytscha*) greater than 26 inches in length, coho salmon (*Oncorhynchus kisutch*) greater than 28 inches in length, lake trout (*Salvelinus namaycush*) of 21 to 26 inches in length, whitefish (*Coregonus clupeaformis*) greater than 23 inches in length, and steelhead (*Oncorhynchus mykiss*) greater than 22 inches in length. The consumption of walleye of 17 to 26 inches in length, brook trout (*Salvelinus fontinalis*) of all sizes, brown trout up to 18 inches in length, chinook salmon up to 26 inches in length, coho salmon of 17 to 28 inches in length, lake trout of up to 21 inches in length, whitefish of up to 23 inches in length, pink salmon (*Oncorhynchus gorbuscha*) of any size, and steelhead of up to 22 inches in length was restricted to one meal per month for adult males and females. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat cyprinids, catostomids, percids, ictalurids, or salmonids (Tables 57 and 59). Finally, it was recommended that the consumption of any undesignated species from named waterways or from any waterways not listed in the FCA be limited to one meal per week.

In 1996, the risk-based approach that was used to establish FCAs based on the concentrations of PCBs in fish tissues was also used to evaluate data on the levels of tissue-associated mercury. However, the data on other COPCs were still evaluated using the USFDA action levels and published reference doses. Based on the data available through 1995, the ISDH, IDEM, and IDNR (1996) recommended in 1996 and 1997 that the following fish from Lake Michigan and its tributaries (within Lake, LaPorte, and Porter counties) not be consumed (Table 59): carp (*Cyprinus carpio*) of any size; golden shiner (*Notemigonus crysoleucas*) of three to six in length, goldfish (*Carassius auratus*) of greater than four inches in length; longnose suckers (*Catostomus catostomus)* greater than 23 inches in length; catfish (*Ictalurus* spp.) of any size; brown trout greater than 27 inches in length; or, lake trout greater than 26 inches in length. The consumption of black crappie (*Pomoxis nigromaculatus*) of greater than eight inches in length, largemouth bass greater than seven inches in length, longnose suckers of 15 to 23 inches in length, white suckers greater than 23 inches in length, walleye of greater than 26 inches in length, brown trout of 18 to 27 inches in length, chinook salmon greater than 26 inches in length, coho salmon greater than 28 inches in length, lake trout of 21 to 26 inches in length, whitefish greater than 23 inches in length, rainbow trout *(Oncorhychus mykiss*) of greater than 22 inches in length, and northern pike (*Esox lucius*) greater than 14 inches in length was restricted to one meal every two months for adult males and females. It was further recommended that adult males and females limit consumption of the following fish to one meal per month: black crappie of seven to eight inches in length; largemouth bass of four to seven inches in length; white suckers of 15 to 23 inches in length; walleye of 17 to 26 inches in length; brook trout of all sizes; brown trout up to 18 inches in length; chinook salmon up to 26 inches in length; coho salmon of 17 to 28 inches in length; lake trout of up to 21 inches in length; whitefish of up to 23 inches in length; pink salmon of any size; rainbow trout of up to 22 inches in length; and, northern pike of 10 to 14 inches in length. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat any of the aforementioned fish species (Tables 57 and 59).

The FCAs that were issued in 1998 were similar in most respects to the FCAs that were issued in 1997. However, the FCA was extended to include freshwater drum (*Aplodinotus grunniens*) and bloater (*Coregonus hoyi*; Table 59). More specifically, adult males and females were advised to restrict consumption of freshwater drum greater than 22 inches in length to one meal every two months and restrict consumption of bloater greater than 10 inches in length to one meal per month. The consumption of freshwater drum of 17 to 22 inches was restricted to one meal per month. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat either of these fish species. The FCA on chinook salmon was also refined to recommend adult males and females not eat fish of greater than 30 inches in length, and limit their consumption of fish up to 26 inches in length and 26 to 30 inches in length to one meal per month and one meal every two months, respectively. For whitefish, it was recommended that adult males and females restrict their consumption to one meal per week for fish of nine to 12 inches, one meal per month for fish of 12 to 20 inches, and one meal every two months for fish of 20 to 24 inches in length. It was further recommended that whitefish greater than 24 inches in length not be eaten. Finally, the FCA provided separate recommendations for rainbow trout (specified above) and steelhead trout (i.e., consumption by adult males and females of steelhead trout of 26 to 32 inches should be restricted to one meal every two months, while larger steelhead should not be eaten).

Although the 1999 FCA was similar in many ways to the FCA that was issued in 1998, it differed in several important respects (Table 59). First, the 1999 FCA did not provide any advice regarding the consumption of golden shiners or goldfish. In addition, several new fish species were included in the 1999 advisory that had not been previously covered under the Indiana FCA, including bluegill (*Lepomis macrochirus*), rock bass (*Ambloplites rupestris*), smallmouth bass (*Micropterus dolomieui*), quillback (*Carpiodes cyprinus*), silver redhorse *(Moxostoma anisurum*), yellow perch (*Perca flavescens*), and round goby (*Neogobius melanostomus*). For adult males and females, the consumption of bluegills of seven to eight inches in length, rock bass of eight to nine inches in length, smallmouth bass of eight to 14 inches in length, yellow perch greater than 10 inches in length, and round goby of three to four inches in length was restricted to one meal per week; women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to restrict their consumption of these fish to one meal per month. The 1999 FCA also recommended that adult males and females restrict their consumption of bluegills greater than eight inches in length, smallmouth bass greater than 14 inches in length, round goby greater than four inches in length, and quillback greater than 20 inches in length to one meal per month. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat these three fish species. It was further recommended that silver redhorse greater than 25 inches in length not be eaten by anyone.

Only minor refinements were made to the Indiana FCA in 2000, as compared to the FCA that was issued in 1999. First, the FCAs on smallmouth bass were revised to recommend that adult males and females limit their consumption of fish 11 to 12 inches in length to one meal per month. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to not eat these fish. It was further recommended that no one consume smallmouth bass greater than 12 inches in length (Table 59). In addition, the FCA on catfish was revised to apply to channel catfish only (i.e., fish of any size should not be eaten). Furthermore, the FCA on freshwater drum was revised to specify that the consumption of fish 14 to 17 inches in length, 17 to 20 inches in length, and greater than 20 inches in length by adult males and females should be restricted to one meal per month, one meal every two months, and no consumption, respectively. No consumption of freshwater drum 14 inches in length or more was advised for women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old.

With one exception, the FCAs that were issued in 2001 and 2002 were the same as those that were issued in 2000 (Table 59). For both 2001 and 2002, the consumption of yellow perch of seven to 10 inches in length was restricted to one meal per week for adult males and females. Women who were planning to have children, pregnant, or breast-feeding and children under the age of 15 years old were advised to restrict their consumption of these fish to one meal per month. Therefore, it is concluded that human uses of fishery resources in IH/LM were injured as a result of the accumulation of PCBs, chlordane, dieldrin and/or DDT, during the period 1985 to 1990, and as a result of the accumulation of PCBs and mercury during the period 1996 to 2002 (Tables 56 and 57).

5.4 Identification of Contaminants of Concern in Sediments and Fish Tissues

Following the assessment of injury to human uses of fishery resources, it is useful to identify the factors that are causing or substantially contributing to adverse effects on human uses of fishery resources. In this report, the bioaccumulative chemicals that occur in sediments or fish tissues at levels that are sufficient to cause or substantially contribute to injury to human uses of fishery resources are termed COCs. The COCs in whole sediments and fish tissues for each geographic area are identified in this section of the report.

The bioaccumulative COCs in whole sediments and fish tissues were identified from the list of COPCs using a three-step process. First, the measured concentrations of COPCs in whole sediments were compared to the bioaccumulation-based SQC. Those substances that occurred in two or more whole sediment samples (separated by more than 100 feet) at concentrations in excess of the corresponding chemical benchmark were identified as sediment-associated COCs. Next, the measured concentrations of COPCs in fish tissues were compared to the benchmarks for tissue chemistry for the protection of human health. Those substances that occurred in one or more fish tissue samples at concentrations in excess of the corresponding chemical benchmark were identified as tissue-associated COCs. Finally, the FCAs that have been issued for the GCR/IHC, for the GCRL, and for IH/LM were reviewed to determine which substance or substances were considered to be the cause of the risk to human health. A substance that was identified as a COPC and that was identified as either a tissue-associated COC or a substance that had driven one or more FCAs was designated as a principal COC. Substances that were identified as sediment-associated COCs, but for which there were no available tissue benchmarks or measured tissue chemistry (i.e., not identified as tissue-associated COCs) were not identified as principal

COCs. This distinction was made because it was not possible to confirm that certain sediment-associated COCs had actually accumulated in fish tissues to levels that would adversely affect human uses of fishery resources.

Grand Calumet River and Indiana Harbor Canal - A number of substances occurred in GCR/IHC sediments at concentrations sufficient to injure human uses of fishery resources (Tables 6 and 7; Appendix 3). More specifically, the sediment-associated COCs in the GCR/IHC include benzene, benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, carbazole, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, beta-hexachlorocyclohexane, lindane, p,p'-DDD, p,p'-DDE, p,p'-DDT, and TCDD-TEQs (Table 60). Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. Chemical benchmarks for assessing hazards to human health associated with the consumption of fish and shellfish tissues (i.e., USFDA action levels, USFDA tolerance levels, or ISDH Group 1 threshold levels) were located for mercury, PCBs, aldrin/dieldrin, chlordane, DDTs, and heptachlor/heptachlor epoxide. Of these substances, the USFDA action level for chlordane (1 of 78 samples) and the USFDA tolerance level for PCBs (70 of 87 samples) was exceeded in one or more of the fish tissue samples collected from the GCR/IHC (Tables 19, 20, and 60; Appendix 5). By comparison, the ISDH Group 1 threshold levels for both mercury and total PCBs were commonly exceeded in fish tissues from this portion of the Assessment Area (Tables 21, 22, and 60). Based on the information provided in the Indiana FCA, PCBs and mercury were the substances responsible for issuance of FCAs in the GCR/IHC between 1986 and 2002 (Tables 56 and 60). Therefore, it is concluded that mercury and total PCBs are the principal COCs in the GCR/IHC (Table 60). Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Grand Calumet River Lagoons - In GCRL sediments, several substances occurred at concentrations sufficient to injure human uses of fishery resources. More specifically, the sediment-associated COCs in the GCRL include benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1242, Arclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, chlordane, dieldrin, endrin, p,p'-DDD, p,p'-DDE, and p,p'-DDT (Tables 6, 7, and 61; Appendix 3). Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. In fish tissues, none of the substances measured occurred at concentrations in excess of the USFDA action levels or tolerance levels within the GCRL (Tables 23 to 35, and 61). However, the ISDH Group 1 advisory threshold levels for both mercury and total PCBs were commonly exceeded in fish tissues from this portion of the Assessment Area (Tables 36, 37, and 61; Appendix 5). Based on the information provided in the Indiana FCA, PCBs were identified as the substance responsible for the issuance of FCAs in the GCRL between 1996 and 2002 (Tables 56 and 60). Therefore, it is concluded that mercury and total PCBs are the principal COCs in the GCRL (Table 61). Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Indiana Harbor and the Nearshore Areas of Lake Michigan - Sediment-associated COPCs commonly occurred in IH/LM sediment samples at concentrations sufficient to injure human uses of fishery resources. More specifically, the COCs in the IH/LM sediments include benz[a]anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1242, total PCBs, and TCDD-TEQs (Tables 6, 7, and 62; Appendix 3). Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. By comparison, only PCBs occurred in fish tissues from IH/LM at concentrations in excess of the USFDA action levels or tolerance levels (Tables 38 to 50, and 62). The ISDH Group 1 advisory threshold levels for both mercury and total PCBs were commonly exceeded in fish tissues from this portion of the Assessment Area, however (Tables 51, 52, and 62). Based on the information provided in the Indiana FCA, PCBs, chlordane, dieldrin, and/or DDT were the substances that are responsible for the issuance of FCAs in IH/LM (Table 62) between 1985 and 1990 (Tables 56 and 62). In recent years (i.e., 1996 to 2002), PCBs and mercury were identified as the responsible substances. Therefore, it is concluded that mercury, total PCBs, chlordane, dieldrin, and DDT are the principal COCs in IH/LM (Table 62). Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

5.5 Evaluation of the Spatial and Temporal Extent of Injury to Human Uses of Fishery Resources

The areal extent of injury to human uses of fishery resources in the Assessment Area was evaluated using the information available on the FCAs. More specifically, the entire geographic area covered by a FCA was considered to have conditions sufficient to injure human uses of fishery resources during each year that a FCA was in effect. The following provides a summary of the spatial and temporal extent of injury to human uses of fishery resources in the Assessment Area.

Grand Calumet River and Indiana Harbor Canal - The FCAs that have been issued for the GCR/IHC generally apply to the WBGCR, EBGCR downstream of the GCRL, and the IHC. Based on the available information, it is apparent that FCAs have been issued each year between 1986 and 2002, with the exception of 1987 and 1988.

Although it was not explicitly stated by the ISBH, it is assumed that the FCA that was issued for the GCR/IHC remained in effect through 1987 and 1988. The FCAs for this portion of the Assessment Area recommended against consumption of any fish species taken from these waters. Therefore, it is concluded that the human uses of fishery resources in the WBGCR, EBGCR downstream of the GCRL, and the IHC have been injured by discharges of oil or releases of other hazardous substances between 1986 and 2002, a period of 17 years. Although FCAs were not issued for this portion of the Assessment Area prior to 1986, the available tissue residue data suggest that the concentrations of PCBs and mercury in fish tissues collected in 1980, 1982, and 1984 were sufficient to injure human uses of fishery resources (i.e., exceeded the ISDH Group 1 threshold levels). Hence, the temporal extent of injury to human uses of fishery resources was probably greater than 17 years. The available sediment chemistry and tissue chemistry data confirm that conditions sufficient to injure human uses of fishery resources occur throughout the GCR/IHC (Figures 5 to 8).

Grand Calumet River Lagoons - The FCAs that have been issued for the GCRL (i.e., Marquette Park Lagoons) apply to the East Lagoon, West Lagoon, Little West Pond, Little East Pond, and the Middle Lagoon. Based on the information provided in the Indiana FCA, it is apparent that FCAs have been issued for the GCRL each year between 1996 and 2002. During the period 1996 to 1998, these FCAs indicated that the consumption of largemouth bass and carp should be restricted or, in some cases avoided. The FCAs issued since 1999 also recommend that the consumption of bluegills from the GCRLs be restricted or avoided. Therefore, it is concluded that human uses of fishery resources (in particular, the uses of bluegill, largemouth bass, and carp) in the GCRL have been injured by discharges of oil or releases of other hazardous substances between 1996 and 2002, a period of seven years. Although FCAs were not issued for this portion of the Assessment Area prior to 1996, the available tissue residue data suggest that the concentrations of PCBs and mercury in fish tissues collected in 1986 were sufficient to injure human uses of fishery resources (i.e., exceeded the ISDH Group 1 advisory threshold levels). Hence, the temporal extent of injury to human uses of fishery resources was probably greater than seven years. The available sediment chemistry and tissue chemistry data confirm that conditions sufficient to injure human uses of fishery resources occur throughout the GCRLs (Figures 5 to 8).

Indiana Harbor and the Nearshore Areas of Lake Michigan - The first FCA for Lake Michigan was issued by the ISBH in 1977 to address concerns related to the accumulation of COPCs in lake trout. Between 1983 and 1989, the FCA was expanded to include other fish species that are caught in the Lake Michigan sport fishery, including carp, catfish, brown trout, chinook salmon, coho salmon, and steelhead. The FCA that was issued in 1986 explicitly included all fish species caught in Indiana Harbor. Between 1990 and 2002, FCAs were issued each year to provide the public with guidance on the consumption of sport-caught fish from Lake Michigan and associated tributaries. Fish consumption advisories were issued in 1977, 1983, 1985 to 1987, and 1989 to 2002 and restricted consumption of more than 30 species of fish that occur in IH/LM. As the 1977, 1983, and 1987 FCAs were not revoked by ISDH, it is reasonable to assume that these FCAs remained in effect during 1978 to 1982, 1984, and 1988, respectively. Therefore, it is concluded that the human uses of fishery resources present in Indiana Harbor and the nearshore areas of Lake Michigan have been injured by discharges of oil or releases of other hazardous substances during 1977-2002 a period of 25 years. Although there are numerous sources of COCs within the Lake Michigan basin, it is likely that the oil and other hazardous substances originating from Indiana Harbor (and elsewhere in the Assessment Area) contributed to the loadings of COCs in tissues of fish utilizing habitats within Lake Michigan. The available sediment chemistry and tissue chemistry data confirm that conditions sufficient to injure human uses of fishery resources occur in Indiana Harbor and in nearby areas within Lake Michigan (Figures 5 to 8).

6.0 Summary and Conclusions

This investigation was conducted to determine if biological resources within the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, Indiana Harbor and the nearshore areas of Lake Michigan (i.e., the Assessment Area) have been injured due to discharges of oil or releases of other hazardous substances, as defined in 43 CFR § 11.62(f)(1)(ii) and (iii) in the United States Department of the Interior (USDOI) regulations for conducting natural resource damage assessments (NRDAs; CFR 2002). In this report, the term injury to human uses of fishery resources has been used to more specifically describe such injuries to biological resources. If the results of this assessment indicated that injury to human uses of fishery resources has occurred within the Assessment Area, then the subsequent objectives of this investigation were to identify contaminants of concern (COCs; i.e., those toxic or bioaccumulative substances that occur in sediments and/or fish tissues at concentrations that are sufficient to cause or substantially contribute to injury to human uses of fishery resources) in the Assessment Area and to evaluate the areal and temporal extent of injury to human uses of fishery resources.

In accordance with the Assessment Plan (Natural Resources Trustees 1997), this assessment of injury to human uses of fishery resources was focused on evaluating the effects on human use and/or consumption of fish that have occurred due to discharges of oil or releases of other hazardous substances. As defined in the assessment plan (Natural Resources Trustees 1997), the primary chemicals of potential concern (COPCs; i.e., the substances that could, potentially, be adversely affecting human uses of fishery resources) in the Assessment Area include polychlorinated biphenyls (PCBs), oil and oil-related compounds (including alkanes, alkenes, naphthalenes, and polycyclic aromatic hydrocarbons; PAHs), and metals (Natural Resources Trustees 1997). The other substances that were considered as COPCs in this investigation include various pesticides, chlorinated benzenes, chlorophenols, phthalates, and polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs). As many of these substances tend to become associated with sediments upon release into aquatic ecosystems, sediment contamination represents a concern with respect to the restoration of beneficial uses in the Assessment Area (IDEM 1991). Subsequent transfer of bioaccumulative substances to sediment-dwelling organisms and, ultimately, to fish and shellfish also has the potential to adversely affect beneficial uses within the Assessment Area, including the utilization of fishery resources by the public.

To facilitate this evaluation, the Assessment Area was initially divided into nine separate reaches, including the Grand Calumet River Lagoons (GCRL), East Branch Grand Calumet River-I (EBGCR-I), East Branch Grand Calumet River-II (EBGCR-II), West Branch Grand Calumet River-I (WBGCR-I), West Branch Grand Calumet River-II (WBGCR-II), Indiana Harbor Canal (IHC), Lake George Branch (LGB), US Canal (USC) and Indiana Harbor/Lake Michigan (IH/LM; i.e., consistent with the approach used by MacDonald and Ingersoll 2000). In each of these reaches, the available sediment quality, tissue quality, and related information was collected, evaluated, and compiled. Subsequently, the data on seven of the nine reaches was consolidated to support the assessment of injury to human uses of fishery resources within the Grand Calumet River and Indiana Harbor Canal (GCR/IHC). Injury to human uses of fishery resources was also evaluated within the GCRL, and IH/LM. Division of the Assessment Area into these three areas facilitated implementation of a geographically consistent approach to the assessment of injury to human uses of fishery resources using all three of the indicators that were selected [i.e., sediment chemistry, tissue chemistry, and fish consumption advisories (FCAs); i.e., FCAs have been issued for these three geographic areas only].

An overview of the environmental issues and concerns in the Assessment Area, the study objectives, and the study approach are presented in Section 1 of this report. The geographic scope of the Assessment Area, the COPCs, and the natural resources contained within the Assessment Area are described in Section 2. More detailed narratives on the study approach and on the data sets that were used in this assessment are provided in Sections 3 and 4, respectively. Finally, the results of the assessment are presented in Section 5 of this report. A summary of these results is presented below to provide an overview of sediment quality, tissue quality, and related conditions within the Assessment Area, as they relate to injury of human uses of fishery resources.

Injury to Human Uses of Fishery Resources

An assessment of injury to human uses of fishery resources associated with discharges of oil or releases of other hazardous substances was conducted for the Grand Calumet River and Indiana Harbor Canal, Grand Calumet River Lagoons, and Indiana Harbor and the nearshore areas of Lake Michigan. The definitions of injury to biological resources included in the USDOI regulations were generally applied to support this assessment of the effects of chemical contamination on human use and consumption of fish and shellfish [i.e., injury to human uses of fishery resources; 43 CFR § 11.62(f)(1)(ii and iii); CFR 2002]. That is, a total of three indicators were used to assess injury to human uses of fishery resources, including sediment chemistry, tissue chemistry, and FCAs.

In this report, injury to human uses of fishery resources was defined as the presence of conditions that have adversely affected or are sufficient to adversely affect the human use and/or consumption of fish. Accordingly, injury to the human uses of fishery resources is considered to be equivalent to injury to biological resources, as defined in the USDOI regulations for conducting NRDAs [43 CFR § 11.62(f)(1)(ii and iii); CFR 2002]. Injury to human uses of fishery resources was assessed for each of the areas defined above (i.e., the GCR/IHC, GCRL, and IH/LM). Three separate lines of evidence were used to determine if injury to human uses of fishery resources has occurred. More specifically, injury to human uses of fishery resources was considered to have occurred if the concentrations of one or more COPCs in two or more whole-sediment samples (separated by more than 100 feet) from an area exceeded the selected chemical benchmarks for the protection of human health. In addition, human uses of fishery resources were considered to have been injured if the concentrations of one or more COPCs in one or more fish tissue samples from an area exceeded the selected chemical benchmarks for the protection of human health [i.e., the tolerance levels or action levels that have been promulgated by the United States Food and Drug Administration (USFDA) **or** the Group 1 threshold levels that have been established by the Indiana State Department of Health (ISDH) to support the development of FCAs]. Furthermore, issuance of FCAs on one or more species of fish within an area was considered to provide the necessary and sufficient evidence of injury to human uses of fishery resources.

Grand Calumet River/Indiana Harbor Canal - Evaluation of the sediment chemistry data that were compiled in the project database indicate that sediments from the GCR/IHC have concentrations of numerous COPCs sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. There were exceedances of one or more of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of PAHs, PCBs, organochlorine pesticides, and/or other substances were measured (i.e., n=up to 244 for surficial samples and n=up to 127 for sub-surface samples). Therefore, it is concluded that concentrations of PAHs, PCBs, and/or other bioaccumulative substances occur in sediments from the GCR/IHC at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, and certain other chlorophenols, PAHs, and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Comparison of the available data on the levels of COPCs in the edible tissues of goldfish, white sucker, channel catfish, gizzard shad, sunfish, pumpkinseed, and carp from the GCR/IHC to the selected benchmarks for tissue chemistry indicates that mercury and PCBs frequently occurred at concentrations sufficient to injure human uses of fishery resources. Overall, 83% (70 of 87 samples) of the fish tissue samples collected from GCR/IHC had concentrations total PCBs that exceeded the tolerance levels that have been established by the USFDA. In addition, the Group 1 threshold concentrations of mercury and PCBs that were established by the ISDH were commonly exceeded in the edible tissues of fish from this portion of the Assessment Area (i.e., 6 of 86 samples for mercury and 87 of 87 samples for total PCBs). Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs have occurred at concentrations sufficient to injure human uses of fishery resources in the GCR/IHC. Organochlorine pesticides (i.e., chlordane) in the edible tissues of fish only rarely posed a potential risk to human health, based on comparisons to the USFDA action levels. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if certain other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

In 1986, the Indiana State Board of Health (ISBH; which is now referred to as ISDH) advised the public to not eat any fish caught in the GCR/IHC due to the high levels of contamination in fish tissues. Since that time, FCAs have been explicitly issued in 12 additional years, including 1989 to 1994 and 1997 to 2002. As the 1986 and 1994 FCAs were not revoked by ISDH, it is reasonable to assume that these FCAs remained in effect during 1987 to 1988 and 1995 to 1996, respectively. Therefore, it is concluded that human uses of fishery resources in the GCR/IHC were injured during the period 1986 to 2002 as a result of the accumulation of mercury and PCBs in fish tissues.

Three lines of evidence, including information on sediment chemistry, tissue chemistry, and FCAs, were used to determine if injury to human uses of fishery resources has occurred within the GCR/IHC. All three lines of evidence indicate that human uses of fishery resources in the GCR/IHC have been injured, particularly due to the presence of mercury, PCBs, and/or chlordane in environmental media (i.e., whole sediments and edible fish tissues). Therefore, it is concluded that human uses of fishery resources in the GCR/IHC have been injured as a result of discharges of oil or releases of other hazardous substances.

Grand Calumet River Lagoons - Comparison of the measured levels of COPCs in whole sediment samples with the benchmarks for sediment chemistry indicate that a number of COPCs occur in GCRL sediments at concentrations sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. There were exceedances of one or more of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of PAHs, PCBs, and/or organochlorine pesticides were measured (i.e., n=up to 127 for surficial samples and n=up to 2 for sub-surface samples). Therefore, it is concluded that concentrations of PAHs, PCBs, and/or other bioaccumulative substances occur in sediments from the

GCRL at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, chlorophenols, tetrachlorodibenzo-*p*-dioxin - toxic equivalents (TCDD-TEQs), and certain other PAHs and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

Evaluation of available tissue chemistry data indicate that the levels of certain COPCs occurred in the edible tissues of carp, largemouth bass and/or bluegills at concentrations sufficient to injure human uses of fishery resources. While the USFDA action levels or tolerance levels were never exceeded in fish tissue samples collected from GCRL, the levels of mercury in 14% (i.e., 3 of 21 samples) and total PCBs in 100% (i.e., n=25) of the samples exceeded the Group 1 threshold levels that have been established by the ISDH. Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs have occurred at concentrations sufficient to injure human uses of fishery resources in the GCRL. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

FCAs have been issued for three species of fish from the GCRL. The FCAs on largemouth bass and carp have been effect from 1996 to 2002. In 1999, the ISDH also issued a FCA on bluegills. Therefore, it is concluded that human uses of fishery resources in the GCRL were injured during the period 1996 to 2002 as a result of the accumulation of PCBs in fish tissues.

Three lines of evidence, including information on sediment chemistry, tissue chemistry, and FCAs, were used to determine if injury to human uses of fishery resources has occurred within the GCRL. All three lines of evidence indicate that human uses of fishery resources in the GCRL have been injured, particularly due to the presence of mercury and PCBs in environmental media (i.e., whole sediments and edible fish tissues). Therefore, it is concluded that human uses of fishery resources in the GCRL have been injured as a result of discharges of oil or releases of other hazardous substances.

Indiana Harbor and the Nearshore Areas of Lake Michigan - Although fewer sediment chemistry data are available for IH/LM than are available for the other portions of the Assessment Area, evaluation of these data indicate that sediments from the IH/LM have conditions that are sufficient to alter the chemical composition of fish tissues to such an extent that the human uses of fishery resources would be adversely affected. There were exceedances of one or more of the selected benchmarks for the protection of human health in all of the samples from this portion of the Assessment Area in which the concentrations of PAHs, PCBs, organochlorine pesticides and/or other bioaccumulative substances were measured (i.e., n=up to 30 for surficial samples). No data were available on the chemical composition of sub-surface sediments. Therefore, it is concluded that concentrations of PAHs, PCBs, and other bioaccumulative substances occur in IH/LM sediments at levels that are sufficient to result in the bioaccumulation of these substances in fish tissues to concentrations that pose a human health concern. Insufficient information (e.g., lack of sediment chemistry data or chemical benchmarks for sediments) was available to determine if other sediment-associated COPCs, such as metals, chlorinated benzenes, phthalates, chlorophenols, and certain other PAHs and pesticides, occurred at concentrations in sediments sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

The available data on COPC concentrations in the edible fish tissues of brown trout, carp, gizzard shad, longnose sucker, sunfish, and yellow perch were compared to the selected benchmarks for tissue chemistry to determine if injury to human uses of fishery resources has occurred within IH/LM. The results of this evaluation indicate that the USFDA tolerance level for PCBs was exceeded in 18% (i.e., 4 of 22 samples) fish tissue samples from IH/LM. In addition, 19% (4 of 21 samples) and 86% (i.e., 19 of 22 samples) of the fish tissue samples from this portion of the Assessment Area had concentrations of mercury and total PCBs, respectively, that exceeded the Group 1 threshold levels that were established by the ISDH. Therefore, evaluation of the available data on the levels of COPCs in fish tissues indicates that mercury and PCBs have occurred at concentrations sufficient to injure human uses of fishery resources in IH/LM. Insufficient information (e.g., lack of tissue residue data or chemical benchmarks for fish tissues) was available to determine if other tissue-associated COPCs, such as PAHs, PCDDs/PCDFs, other metals, pesticides, chlorinated benzenes, chlorophenols, or phthalates occurred at concentrations in fish tissues sufficient to injure human uses of fishery resources in this portion of the Assessment Area (i.e., it was not possible to determine if these substances were COCs).

The first FCA for Lake Michigan was issued by the ISBH in 1977 to address concerns related to the accumulation of COPCs in lake trout. Between 1983 and 1989, the FCA was expanded to include various other fish species that were caught in the Lake Michigan sport fishery, including carp, catfish, brown trout, chinook salmon, coho salmon, and steelhead. The FCA that was issued in 1986 explicitly included all fish species caught in Indiana Harbor. Between 1990 and 2002, FCAs were issued each year to provide the public with guidance on the consumption of sport-caught fish from Lake Michigan and associated tributaries. In total, these FCAs restricted consumption of more than 30 species of fish that occur in Indiana Harbor and/or the nearshore areas of Lake Michigan during 1977, 1983, 1985 to 1987, and 1989 to 2002. As the 1977, 1983, and 1987 FCAs were not revoked by ISDH, it is reasonable to assume that these FCAs were also in effect during 1978 to 1982, 1984, and 1988. Therefore, it is concluded that human uses of fishery resources in Indiana Harbor and the nearshore areas of Lake Michigan were injured during the period 1977 to 2002 as a result of the accumulation of mercury, PCBs, chlordane, dieldrin, and/or DDTs in fish tissues.

Three lines of evidence, including information on sediment chemistry, tissue chemistry, and FCAs, were used to determine if injury to human uses of fishery resources has occurred within IH/LM. All three lines of evidence indicate that human uses of fishery resources in the IH/LM have been injured, particularly due to the presence of mercury, PCBs, chlordane, dieldrin, and DDTs in environmental media (i.e., whole sediments and edible fish tissues). Therefore, it is concluded that human uses of fishery resources in IH/LM have been injured as a result of discharges of oil or releases of other hazardous substances.

Contaminants of Concern

In this investigation, COCs were identified as those substances that occurred in whole sediments and/or edible fish tissues at concentrations that are sufficient to cause or substantially-contribute to injury to human uses of fishery resources. For each area, the sediment-associated COCs were identified as those substances that occurred in two or more whole-sediment samples at concentrations in excess of the corresponding chemical benchmark. Likewise, the tissue-associated COCs for an area included those substances that occurred in one or more fish tissue samples at concentrations in excess of the corresponding chemical benchmark (i.e., the tolerance levels or action levels that have been promulgated by the USFDA **or** the Group 1 threshold levels that have been established by ISDH to support the development of FCAs). Finally, the FCAs that have been issued for the GCR/IHC, for the GCRL, and for IH/LM were reviewed to determine which substance or substances were considered to be responsible for the risk to human health. A substance that was identified as a COPC and that was identified as either a tissue-associated COC or a substance that had driven one or more FCAs was designated as a principal COC. Substances that were identified as sediment-associated COCs, but for which there were no available tissue benchmarks or measured tissue chemistry (i.e., not identified as tissue-associated COCs) were not identified as principal COCs. The principal COCs are those substances that have been demonstrated to be associated with injury.

Grand Calumet River and Indiana Harbor Canal - The sediment-associated COCs in the GCR/IHC include benzene, benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, carbazole, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, beta-hexachlorocyclohexane, lindane, p,p'-DDD, p,p'-DDE, p,p'-DDT, and TCDD-TEQs. Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. Comparison of the tissue chemistry data to the selected benchmarks for assessing hazards to human health associated with the consumption of fish tissues indicated that mercury, PCBs, and chlordane are the tissue-associated COCs in the GCR/IHC. Mercury and/or PCBs were identified as the substances responsible for the issuance of FCAs in the GCR/IHC between 1996 and 2002. Therefore, it is concluded that mercury and PCBs are the principal COCs in the GCR/IHC; additional benchmarks for tissue chemistry are needed to confirm that other COPCs (e.g., various PAHs, certain organochlorine pesticides, or TCDD-TEQs) occur in fish tissues at levels sufficient to injure human uses of fishery resources.

Grand Calumet River Lagoons - The sediment-associated COCs in the GCRL include benz[a]anthracene; benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1242, Arclor 1248, Aroclor 1254, Aroclor 1260, total PCBs, chlordane, dieldrin, endrin, p,p'-DDD, p,p'-DDE, and p,p'-DDT. Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. In fish tissues, the substances that exceeded the USFDA action levels, the USFDA tolerance levels, or the ISDH Group 1 threshold levels included mercury and total PCBs. Based on the information provided in the Indiana FCA, PCBs were identified as the substances responsible for the issuance of FCAs in the GCRL between 1996 and 2002. Therefore, it is concluded that mercury and PCBs are the principal COCs in the GCRL; additional benchmarks for tissue chemistry are needed to confirm that other COPCs (e.g., various PAHs, certain organochlorine pesticides, or TCDD-TEQs) occur in fish tissues at levels sufficient to injure human uses of fishery resources.

Indiana Harbor and the Nearshore Areas of Lake Michigan - The sediment-associated COCs in IH/LM include benz[a]anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1242, total PCBs, and TCDD-TEQs. Additional benchmarks for sediment chemistry are needed to confirm that other COPCs (e.g., metals and certain PAHs) occur in sediments at levels sufficient to injure human uses of fishery resources. Both mercury and PCBs were identified as tissue-associated COCs, based on exceedances of the USFDA action levels, USFDA tolerance levels, or ISDH Group 1 threshold levels. Based on the information provided in the Indiana FCA, PCBs, chlordane, dieldrin, and/or DDTs were the substances that were responsible for the issuance of FCAs in IH/LM between 1985 and 1990. In recent years (i.e., 1996 to 2002), PCBs and mercury were identified as the causative substances. Therefore, it is concluded that mercury, PCBs, chlordane, dieldrin, and DDTs are the principal COCs in IH/LM; additional benchmarks for tissue chemistry are needed to confirm that other COPCs (e.g., various PAHs, certain organochlorine pesticides, or TCDD-TEQs) occur in fish tissues at levels sufficient to injure human uses of fishery resources.

Spatial and Temporal Extent of Injury to Human Uses of Fishery Resources

In this investigation, the areal and temporal extent of injury to human uses of fishery resources was evaluated using the information in the Indiana FCAs. More specifically, the entire geographic area covered by a FCA was considered to have conditions sufficient to injure human uses of fishery resources during each year that a FCA was in effect.

Grand Calumet River and Indiana Harbor Canal - The FCAs that have been issued for the GCR/IHC generally apply to the West Branch of the Grand Calumet River (WBGCR), East Branch of the Grand Calumet River (EBGCR) downstream of the GCRL, and the IHC. However, the FCA that was issued in 1986 also included the LGB and Indiana Harbor. Based on the information evaluated, it is apparent that FCAs have been issued each year between 1986 and 2002, with the exception of 1987 and 1988. Although it was not explicitly stated by the ISBH, it is assumed that the FCA that was issued for the GCR/IHC remained in effect through 1987 and 1988. The FCAs for this portion of the Assessment Area recommended against consumption of any fish species taken from these waters. Therefore, it is concluded that the human uses of fishery resources in the GCR and IHC have been injured by discharges of oil or releases of other hazardous substances between 1986 and 2002, a period of 17 years. The human uses of fishery resources present in the LGB were injured during 1986, a period of one year.

Grand Calumet River Lagoons - The FCAs that have been issued for the GCRL apply to the East Lagoon, West Lagoon, Little West Pond, Little East Pond, and the Middle Lagoon. Based on the information provided in the Indiana FCA, it is apparent that FCAs have been issued for the GCRL each year between 1996 and 2002. During the period 1996 to 1998, these FCAs indicated that the consumption of largemouth bass and carp should be restricted or, in some cases avoided. The FCAs issued since 1999 also recommend that the consumption of bluegills from the GCRLs be restricted or avoided. Therefore, it is concluded that the human uses of fishery resources (in particular, the uses of bluegill, largemouth bass, and carp) in the GCRL have been injured by discharges of oil or releases of other hazardous substances between 1996 and 2002, a period of seven years.

Indiana Harbor and the Nearshore Areas of Lake Michigan - In this investigation, the FCAs that have been issued for Lake Michigan (or Lake Michigan and tributaries) were considered to apply to IH/LM. In total, these FCAs restricted consumption of more than 30 species of fish that occur in Indiana Harbor and/or the nearshore areas of Lake Michigan. Fish consumption advisories have been explicitly issued for IH/LM for a total of 19 years, including 1977, 1983, 1985 to 1987, and 1989 to 2002. As the FCAs that were issued in 1977, 1983, and 1987 were not revoked by ISDH, it is concluded that human uses of fishery resources in IH/LM have been injured by discharges of oil or releases of other hazardous substances between 1977 and 2002, a period of 26 years. Although there are numerous sources of COCs within the Lake Michigan basin, it is likely that the oil and other hazardous substances originating from Indiana Harbor (and elsewhere in the Assessment Area) contributed to the loadings of COCs in tissues of fish utilizing habitats within the nearshore areas of Lake Michigan.

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Tables

Table 1. Summary of data sets used to assess sediment quality conditions in the Assessment Area.

Sampling Year	Geographic Area	Reach	Surface Sediment (n)	Sub-surface Sediment (n)	PCBs	PAHs	Metals	Pesticides	PCDDs and PCDFs	Conventional Variables	SEM	ABN	Reference
1980	GCR/IHC	USC	3		✓		✓			✓		✓	USACE (1980)
1987	GCR/IHC	LGB, USC	3		✓		✓			✓			Polls (1988)
1987	IH/LM	IH/LM	27		✓		✓			✓			Polls (1988)
1988	GCR/IHC	LGB, USC	9		✓	✓	✓			✓		✓	Risatti & Ross (1989)
1988	IH/LM	IH/LM	16										Risatti & Ross (1989)
1989	GCR/IHC	USC	5		✓	✓	✓	✓	✓	✓	✓	✓	USEPA (1996a)
1989	IH/LM	IH/LM	2		✓	✓	✓	✓	✓	✓	✓	✓	USEPA (1996a)
1988, 90, 92, 94	GCR/IHC	EBGCR I, EBGCR II, WBGCR II, IHC, USC	19		✓	✓	✓	✓		✓		✓	IDEM (1994)
1990	GCR/IHC	EBGCR I, EBGCR II, WBGCR I, WBGCR II, IHC, USC	10		✓	✓	✓	✓	✓	✓		✓	Hoke *et al.* (1993)
1991	GCR/IHC	EBGCR I, EBGCR II, WBGCR I, IHC	59	58	✓	✓	✓		✓	✓	✓	✓	Floyd-Browne (1993)
1991	GCR/IHC	USC	13			✓	✓					✓	USEPA (1991)
1991	IH/LM	IH/LM	8			✓	✓					✓	USEPA (1991)
1993	GCR/IHC	WBGCR II	32	29		✓	✓			✓		✓	Burton (1994); Dorkin (1994)
1993	GCR/IHC	USC		18	✓	✓	✓	✓		✓		✓	USACE (1994)

Table 1. Summary of data sets used to assess sediment quality conditions in the Assessment Area.

Sampling Year	Geographic Area	Reach	Surface Sediment (n)	Sub-surface Sediment (n)	PCBs	PAHs	Metals	Pesticides	PCDDs and PCDFs	Conventional Variables	SEM	ABN	Reference
1995	GCRL	GCRL		19		✓	✓			✓			Gillespie *et al.* (1998); USDOI (1994)
1996	GCRL	GCRL	5	1	✓	✓	✓	✓		✓		✓	USACE (1996)
1997-98	GCR/IHC	EBGCR II	56		✓	✓	✓	✓					Simon (2000)
1997-98	GCRL	GCRL	192		✓	✓	✓	✓					Simon (2000)
1998	GCR/IHC	EBGCR I	49	51	✓	✓	✓	✓		✓	✓	✓	Exponent (1999)
1998	GCR/IHC	WBGCR II	14	11		✓	✓			✓		✓	Thermoretec (1999)
1998	GCR/IHC	WBGCR II	8	11	✓	✓	✓	✓				✓	URS Greiner Woodward Clyde (1999)
1999	GCR/IHC	EBGCR I, WBGCR I, LGB, IHC	81	40	✓	✓	✓	✓		✓	✓	✓	Maxim Technologies (1999)
1999	GCRL	GCRL	5		✓	✓	✓	✓		✓	✓		Maxim Technologies (1999)
Total for Each Area													
	GCR/IHC		**361**	**218**									
	IH/LM		**53**	**0**									
	GCRL		**202**	**20**									
Total for Assessment Area			***616***	***238***									

SEM = simultaneously extracted metals; ABN = acid-base neutrals; GCR/IHC = Grand Calumet River/Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; USC = U.S. Canal; LGB = Lake George Branch; EBGCR I & II= East Branch Grand Calumet River I and II; WBGCR I & II = West Branch Grand Calumet River I & II; IHC = Indiana Harbor Canal; PCDDs = polychlorinated dibenzo-*p*- dioxins; PCDFs = polychlorinated dibenzofurans; PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls.

Table 2. Selected benchmarks for sediment chemistry for assessing injury to human uses of fishery resources (WSDOH 1995; 1996).

Chemicals of Potential Concern	SQC
Metals (mg/kg OC)	
Mercury	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)	
Acenapthene	NG
Acenaphthylene	NG
Anthracene	NG
Benzene	8000
Carbazole	12000
Fluorene	NG
2-Methylnaphthalene	NG
Naphthalene	NG
Phenanthrene	NG
Benz[a]anthracene	69
Benzo(b)fluoranthene	69
Benzo(k)fluoranthene	69
Benzo(a)pyrene	69
Chrysene	44
Dibenz[a,h]anthracene	69
Fluoranthene	NG
Indeno(1,2,3-cd)pyrene	69
Pyrene	NG
Total PAHs	NG
Polychlorinated Biphenyls (PCBs; µg/kg OC)	
Aroclor 1016	4.9
Aroclor 1242	1.7
Aroclor 1248	1.7
Aroclor 1254	1.7
Aroclor 1260	1.7
Total PCBs	1.7[1]
Chlorinated Benzenes (µg/kg OC)	
Hexachlorobenzene (HCB)	310
Hexachlorobutadiene (HCBD)	8100
Phthalates (µg/kg OC)	
Bis(2-ethylhexyl)phthalate	36000
Chlorophenols (µg/kg OC)	
2,4-Dichlorophenol	450000
2,4,6-Trichlorophenol	8700
Pentachlorophenol	4200

Table 2. Selected benchmarks for sediment chemistry for assessing injury to human uses of fishery resources (WSDOH 1995; 1996).

Chemicals of Potential Concern	SQC
Pesticides (µg/kg OC)	
Aldrin	0.13
Chlordane	1.7
Dieldrin	0.14
p,p'-DDD	9.1
p,p'-DDE	5.5
p,p'-DDT	6.5
Endosulfan	36000
Endrin	550
Heptachlor	1.3
Heptachlor epoxide	0.65
Alpha-hexachlorocyclohexane (HCH)	0.94
Beta-HCH	3.2
Technical-HCH	3.3
Lindane (gamma-HCH)	4.6
PCDDs and PCDFs (µg/kg OC)	
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	12
1,2,3,4,6,7,8-Heptachlorodibenzofuran	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran	12
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	0.046
1,2,3,4,7,8-Hexachlorodibenzofuran	0.046
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	0.046
1,2,3,6,7,8-Hexachlorodibenzofuran	0.046
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	0.046
1,2,3,7,8,9-Hexachlorodibenzofuran	0.046
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	0.0092
1,2,3,7,8-Pentachlorodibenzofuran	0.026
2,3,4,6,7,8-Hexachlorodibenzofuran	0.046
2,3,4,7,8-Pentachlorodibenzofuran	0.0031
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	0.00015
2,3,7,8-Tetrachlorodibenzofuran	0.013
Octachlorodibenzodioxin	120
Octachlorodibenzofuran	120
TCDD-TEQ	0.00015[2]

OC = organic carbon; NG = no guideline is available; SQC = sediment quality criteria;
TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p*-dioxins;
PCDFs = polychlorinated dibenzofurans.

[1]Adopted guideline for the majority of the Aroclors.
[2]Adopted guideline for 2,3,7,8-tetrachlorodibenzo-*p*- dioxin.

Table 3. Selected tolerance levels and action levels that have been established by U.S. Food and Drug Administration under Section 402 of the Food, Drug, and Cosmetic Act (21 U.S.C. 342) for the edible portions of fish and shellfish (USFDA 2001).

Chemical of Potential Concern (WW units)	Benchmark [1]	Benchmark Type	Regulation	Refinements
Polychlorinated biphenyls (µg/kg)	2000	Tolerance Level	21 CFR 109.30	1984 - refined from 5000 to 2000 µg/kg
Methylmercury (mg/kg)	1.0	Action Level	Sec 540.600 CPG	1979 - refined from 0.5 to 1.0 mg/kg
Chlordane (µg/kg)[2]	300	Action Level	Sec 575.100 CPG	
DDT, TDE (DDD), and DDE (µg/kg)[3]	5000	Action Level	Sec 575.100 CPG	
Aldrin and dieldrin (µg/kg)[4]	300	Action Level	Sec 575.100 CPG	
Heptachlor and heptachlor epoxide (µg/kg)[5]	300	Action Level	Sec 575.100 CPG	
Chlordecone (kepone; µg/kg)	300	Action Level	Sec 575.100 CPG	
Mirex (µg/kg)	100	Action Level	Sec 575.100 CPG	

WW = wet weight; CFR = Code of Federal Regulations; CPG = Compliance Policy Guide; USFDA = United States Food and Drug Administration.

[1]USFDA 2001. Applies to the edible portion of fish (the term "fish" refers to fresh or saltwater fish, crustaceans, all molluscs, and other forms of aquatic animal life other than birds or mammals, as defined in 21 Code of Federal Regulations 123.3 (d).

[2]Action level is for residues of chlordane, including cis and trans chlordane, cis and trans nonachlor, oxychlordane, alpha, beta, and gamma chlordane and chlordane. Levels of individual components must be quantitated at 20 µg/kg or above and confirmed in order to be added into the "chlordane" total value.

[3]The action level applies to residues of the pesticide and its metabolites individually or in combination. In adding amounts of DDT, TDE (DDD), and DDE, any of the three found below 200 µg/kg were not counted.

[4]The action level applies to residues of the pesticide and its metabolite individually or in combination. In adding amounts of aldrin and dieldrin, levels below 100 µg/kg were not counted.

[5]The action level applies to residues of the pesticide and its metabolite individually or in combination. In adding amounts of heptachlor or heptachlor epoxide, levels below 100 µg/kg were not counted.

Table 4. Selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory (Stahl and Simon 2000).

Substance	Tissue Type	Categorical Grouping	Tissue Concentration
Polychlorinated biphenyls (µg/kg WW)[1]	Skin-on scaleless[2]	1	0 - 50
		2	60 to 200
		3	210 to 1000
		4	1100 to 1900
		5	> 1900
Polychlorinated biphenyls (µg/kg WW)[1]	Skin-off fillets[3]	1	0 - 36
		2	37 to 156
		3	157 to 675
		4	676 to 1350
		5	> 1360
Mercury (mg/kg WW)[4]	Edible tissue portions[5]	1	0 - 0.16
		2	0.16 to 0.65
		3	0.66 to 2.80
		4	2.81 to 4.5
		5	> 4.5

WW = wet weight.

[1]Based on a Human Health Protection Value of 0.05 µg/kg/day of PCB consumption, which equates to a daily exposure rate of 3.5 µg/day for total PCBs (Anderson *et al.* 1993).
[2]Based on the assumption that skinning/trimming/cooking reduces residues by 50% from raw, skin-on fillets (Anderson *et al.* 1993).
[3]Based on the assumption that skinning/trimming/cooking reduces residues by 30% from raw skin-off fillets from scaleless species such as catfish (Anderson *et al.* 1993).
[4]Mercury burden thresholds are based on a reference dose (RfD) of 0.3 mg/kg/day and there are no reduction factors for preparation (USEPA recommends a reference dose of 0.1 mg/kg/day - Indiana accounts for this with the "bump-up factor" for sensitive populations; Stahl and Simon 2000).
[5]There is no reduction factor for preparation because mercury tends to concentrate throughout the edible portion (Stahl and Simon 2000).

Table 5. Summary of fish tissue chemistry data sets used to assess injury to human uses of fishery resources in the Assessment Area.

			Fish Species Sampled	Tissue Chemistry				
Geographic Area	**Sampling Date**	**n**	**Common Name (*Scientific Name*)**	**Conventionals**	**Metals**	**PCBs**	**Pesticides**	**Reference**
GCR/IHC	1980	1	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1982	2	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1984	2	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1986	9	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1987	5	Carp (*Cyprinus carpio*); Pumpkinseed (*Lepomis gibbosus*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1988	2	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1988	9	Carp (*Cyprinus carpio*); Gizzard shad (*Dorosoma cepedianum*); Sunfish (*Lepomis* [Hybrid])	✓	✓	✓		Risatti & Ross (1989)
GCR/IHC	1990	3	Carp (*Cyprinus carpio*); Goldfish (*Carassius auratus*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1992	4	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1994	18	Carp (*Cyprinus carpio*); Goldfish (*Carassius auratus*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	1996	20	Carp (*Cyprinus carpio*); Goldfish (*Carassius auratus*); White sucker (*Catostomus commersoni*)	✓	✓	✓	✓	IDEM (2000a)
GCR/IHC	2000	16	Carp (*Cyprinus carpio*); Channel catfish (*Ictalurus punctatus*); Goldfish (*Carassius auratus*); White sucker (*Catostomus commersoni*)	✓	✓	✓	✓	IDEM (2000a)
GCRL	1986	4	Carp (*Cyprinus carpio*); Largemouth bass (*Micropterus salmoides*)	✓	✓	✓	✓	IDEM (2000a)
GCRL	1997	3	Bluegill (*Lepomis macrochirus*); Largemouth bass (*Micropterus salmoides*)	✓	✓	✓	✓	IDEM (2000a)
GCRL	1997	18	Carp (*Cyprinus carpio*)	✓	✓	✓	✓	IDEM (2000b)

Table 5. Summary of fish tissue chemistry data sets used to assess injury to human uses of fishery resources in the Assessment Area.

			Fish Species Sampled	Tissue Chemistry				
Geographic Area	**Sampling Date**	**n**	**Common Name (*Scientific Name*)**	**Conventionals**	**Metals**	**PCBs**	**Pesticides**	**Reference**
IH/LM	1988	6	Carp (*Cyprinus carpio*); Longnose sucker (*Catostomus catostomus*); Yellow perch (*Perca flavescens*)	✓	✓	✓	✓	IDEM (2000a)
IH/LM	1988	12	Carp (*Cyprinus carpio*); Gizzard shad (*Dorosoma cepedianum*); Sunfish [*Lepomis* (Hybrid)]; Yellow perch (*Perca flavescens*)	✓	✓	✓		Risatti & Ross (1989)
IH/LM	1996	4	Brown trout (*Salmo trutta*); Carp (*Cyprinus carpio*); Gizzard shad (*Dorosoma cepedianum*)	✓	✓	✓	✓	IDEM (2000a)
Total for Each Area								
GCR/IHC		**91**						
GCRL		**25**						
IH/LM		**22**						
Total for Assessment Area		***138***						

GCR/IHC = Grand Calumet River/Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls.

Table 6. Frequency of exceedance of bioaccumulation-based sediment quality criteria for the protection of human health in surficial sediment samples from the Assessment Area.

Chemical of Potential Concern	GCR/IHC	GCRL	IH/LM	Assessment Area
Metals (mg/kg OC)				
Mercury	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)				
Acenapthene	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG
Benzene	24 of 79 (30%)	NM	NM	24 of 79 (30%)
Carbazole	5 of 5 (100%)	NM	NM	5 of 5 (100%)
Fluorene	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG
Benz[a]anthracene	240 of 240 (100%)	114 of 114 (100%)	10 of 10 (100%)	364 of 364 (100%)
Benzo(a)pyrene	226 of 226 (100%)	125 of 125 (100%)	10 of 10 (100%)	361 of 361 (100%)
Benzo(b)fluoranthene	80 of 80 (100%)	5 of 5 (100%)	NM	85 of 85 (100%)
Benzo(k)fluoranthene	160 of 160 (100%)	6 of 6 (100%)	10 of 10 (100%)	176 of 176 (100%)
Chrysene	244 of 244 (100%)	127 of 127 (100%)	10 of 10 (100%)	381 of 381 (100%)
Dibenz[a,h]anthracene	104 of 104 (100%)	28 of 28 (100%)	6 of 6 (100%)	138 of 138 (100%)
Fluoranthene	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	149 of 149 (100%)	4 of 4 (100%)	10 of 10 (100%)	163 of 163 (100%)
Pyrene	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG
Polychlorinated Biphenyls (PCBs; µg/kg OC)				
Aroclor 1016	NM	NM	NM	NM
Aroclor 1242	8 of 8 (100%)	5 of 5 (100%)	2 of 2 (100%)	15 of 15 (100%)
Aroclor 1248	136 of 136 (100%)	11 of 11 (100%)	NM	147 of 147 (100%)
Aroclor 1254	16 of 16 (100%)	4 of 4 (100%)	1 of 1 (100%)	21 of 21 (100%)
Aroclor 1260	7 of 7 (100%)	13 of 13 (100%)	NM	20 of 20 (100%)
Total PCBs	154 of 154 (100%)	29 of 29 (100%)	30 of 30 (100%)	213 of 213 (100%)
Chlorinated Benzenes (µg/kg OC)				
Hexachlorobenzene (HCB)	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM
Phthalates (µg/kg OC)				
Bis(2-ethylhexyl)phthalate	NM	NM	NM	NM
Chlorophenols (µg/kg OC)				
2,4-Dichlorophenol	0 of 14 (0%)	NM	NM	0 of 14 (0%)
2,4,6-Trichlorophenol	NM	NM	NM	NM
Pentachlorophenol	NM	NM	NM	NM

Table 6. Frequency of exceedance of bioaccumulation-based sediment quality criteria for the protection of human health in surficial sediment samples from the Assessment Area.

Chemical of Potential Concern	GCR/IHC	GCRL	IH/LM	Assessment Area
Pesticides (µg/kg OC)				
Aldrin	NM	NM	NM	NM
Chlordane	27 of 27 (100%)	14 of 14 (100%)	1 of 1 (100%)	42 of 42 (100%)
Dieldrin	21 of 21 (100%)	2 of 2 (100%)	1 of 1 (100%)	24 of 24 (100%)
p,p'-DDD	13 of 13 (100%)	16 of 16 (100%)	NM	29 of 29 (100%)
p,p'-DDE	32 of 32 (100%)	22 of 22 (100%)	1 of 1 (100%)	55 of 55 (100%)
p,p'-DDT	23 of 23 (100%)	22 of 23 (96%)	NM	45 of 46 (98%)
Endosulfan, total	0 of 93 (0%)	0 of 5 (0%)	NM	0 of 98 (0%)
Endrin	2 of 54 (4%)	2 of 22 (9%)	0 of 1 (0%)	4 of 77 (5%)
Heptachlor	17 of 17 (100%)	NM	NM	17 of 17 (100%)
Heptachlor epoxide	12 of 12 (100%)	NM	NM	12 of 12 (100%)
Alpha-hexachlorocyclohexane (	NM	NM	NM	NM
Beta-HCH	6 of 6 (100%)	NM	NM	6 of 6 (100%)
Technical-HCH	NM	NM	NM	NM
Lindane (gamma-HCH)	14 of 14 (100%)	NM	NM	14 of 14 (100%)
PCDDs and PCDFs (µg/kg OC)				
TCDD-TEQ	5 of 15 (33%)	NM	2 of 2 (100%)	7 of 17 (41%)

GCR/IHC = Grand Calumet River/Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; OC = organic carbon; NG = no guideline is available; NM = not measured (or TOC not measured to calculate OC-normalized concentration, or all values were less than detect and the detection limit was greater than the benchmark); PCDDs = polychlorinated dibenzo-*p* -dioxins; PCDFs = polychlorinated dibenzofurans; TCDD-TEQ = tetrachlorodibenzo-*p* -dioxin - toxic equivalents.

Table 7. Frequency of exceedance of bioaccumulation-based sediment quality criteria for the protection of human health in sub-surface sediment samples from the Assessment Area.

Chemical of Potential Concern	GCR/IHC	GCRL	IH/LM	Assessment Area
Metals (mg/kg OC)				
Mercury	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)				
Acenapthene	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG
Benzene	22 of 64 (34%)	NM	NM	22 of 64 (34%)
Carbazole	4 of 10 (40%)	NM	NM	4 of 10 (40%)
Fluorene	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG
Benz[a]anthracene	120 of 120 (100%)	1 of 1 (100%)	NM	121 of 121 (100%)
Benzo(a)pyrene	111 of 111 (100%)	1 of 1 (100%)	NM	112 of 112 (100%)
Benzo(b)fluoranthene	43 of 43 (100%)	NM	NM	43 of 43 (100%)
Benzo(k)fluoranthene	92 of 92 (100%)	2 of 2 (100%)	NM	94 of 94 (100%)
Chrysene	127 of 127 (100%)	1 of 1 (100%)	NM	128 of 128 (100%)
Dibenz[a,h]anthracene	52 of 52 (100%)	NM	NM	52 of 52 (100%)
Fluoranthene	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	83 of 83 (100%)	1 of 1 (100%)	NM	84 of 84 (100%)
Pyrene	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG
Polychlorinated Biphenyls (PCBs; µg/kg OC)				
Aroclor 1016	NM	NM	NM	NM
Aroclor 1242	NM	NM	NM	NM
Aroclor 1248	52 of 52 (100%)	NM	NM	52 of 52 (100%)
Aroclor 1254	3 of 3 (100%)	NM	NM	3 of 3 (100%)
Aroclor 1260	2 of 2 (100%)	NM	NM	2 of 2 (100%)
Total PCBs	52 of 52 (100%)	NM	NM	52 of 52 (100%)
Chlorinated Benzenes (µg/kg OC)				
Hexachlorobenzene (HCB)	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM
Phthalates (µg/kg OC)				
Bis(2-ethylhexyl)phthalate	0 of 1 (0%)	NM	NM	0 of 1 (0%)
Chlorophenols (µg/kg OC)				
2,4-Dichlorophenol	0 of 17 (0%)	NM	NM	0 of 17 (0%)
2,4,6-Trichlorophenol	0 of 4 (0%)	NM	NM	0 of 4 (0%)
Pentachlorophenol	0 of 1 (0%)	NM	NM	0 of 1 (0%)

Table 7. Frequency of exceedance of bioaccumulation-based sediment quality criteria for the protection of human health in sub-surface sediment samples from the Assessment Area.

Chemical of Potential Concern	GCR/IHC	GCRL	IH/LM	Assessment Area
Pesticides (µg/kg OC)				
Aldrin	NM	NM	NM	NM
Chlordane	9 of 9 (100%)	NM	NM	9 of 9 (100%)
Dieldrin	17 of 17 (100%)	NM	NM	17 of 17 (100%)
p,p'-DDD	20 of 20 (100%)	NM	NM	20 of 20 (100%)
p,p'-DDE	18 of 18 (100%)	NM	NM	18 of 18 (100%)
p,p'-DDT	2 of 2 (100%)	NM	NM	2 of 2 (100%)
Endosulfan, total	0 of 56 (0%)	NM	NM	0 of 56 (0%)
Endrin	1 of 46 (2%)	0 of 1 (0%)	NM	1 of 47 (2%)
Heptachlor	1 of 1 (100%)	NM	NM	1 of 1 (100%)
Heptachlor epoxide	4 of 4 (100%)	NM	NM	4 of 4 (100%)
Alpha-hexachlorocyclohexane (	NM	NM	NM	NM
Beta-HCH	3 of 3 (100%)	NM	NM	3 of 3 (100%)
Technical-HCH	NM	NM	NM	NM
Lindane (gamma-HCH)	2 of 2 (100%)	NM	NM	2 of 2 (100%)
PCDDs and PCDFs (µg/kg OC)				
TCDD-TEQ	NM	NM	NM	NM

GCR/IHC = Grand Calumet River/Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; OC = organic carbon; NG = no guideline is available; NM = not measured (or TOC not measured to calculate OC-normalized concentration, or all values were less than detect and the detection limit was greater than the benchmark); PCDDs = polychlorinated dibenzo-*p* -dioxins; PCDFs = polychlorinated dibenzofurans; TCDD-TEQ = tetrachlorodibenzo-*p* -dioxin - toxic equivalents.

Table 8. Frequency of exceedance of the USFDA (2001) action level for mercury (1.0 mg/kg WW) in fish tissues from the Grand Calumet River/ Indiana Harbor Canal.

Species	1980	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 8 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 62 (0%)**
Channel catfish										0 of 1 (0%)	**0 of 1 (0%)**
Gizzard shad					0 of 2 (0%)						**0 of 2 (0%)**
Goldfish						0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
Pumpkinseed				0 of 1 (0%)							**0 of 1 (0%)**
Sunfish					0 of 1 (0%)						**0 of 1 (0%)**
White sucker									0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 5 (0%)**	**0 of 11 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 86 (0%)**

WW = wet weight.

Table 9. Frequency of exceedance of the USFDA (2001) action level for aldrin (300 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 4 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 56 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 5 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 76 (0%)**

WW = wet weight.

Table 10. Frequency of exceedance of the USFDA (2001) action level for dieldrin (300 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

WW = wet weight.

Table 11. Frequency of exceedance of the USFDA (2001) action level for aldrin + dieldrin (300 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

WW = wet weight.

Table 12. Frequency of exceedance of the USFDA (2001) action level for sum DDD (5000 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

Sum DDD = *p,p*'-DDD + *o,p*'-DDD; WW = wet weight.

Table 13. Frequency of exceedance of the USFDA (2001) action level for sum DDE (5000 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channelcatfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

Sum DDE = *p,p'*-DDE + *o,p'*-DDE; WW = wet weight.

Table 14. Frequency of exceedance of the USFDA (2001) action level for sum DDT (5000 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

Sum DDT = *p,p*'-DDT + *o,p*'-DDT; WW = wet weight.

Table 15. Frequency of exceedance of the USFDA (2001) action level for total DDT (5000 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

Total DDT = *p,p*'-DDT, *o,p*'-DDT, *p,p*'-DDE, *o,p*'-DDE, *p,p*'-DDD, and *o,p*'-DDD; WW = wet weight.

Table 16. Frequency of exceedance of the USFDA (2001) action level for heptachlor (300 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 3 (0%)	0 of 3 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 56 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 5 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 76 (0%)**

WW = wet weight.

Table 17. Frequency of exceedance of the USFDA (2001) action level for heptachlor epoxide (300 µg/kg WW) in fish tissues from the Grand Calumet River/ Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

WW = wet weight.

Table 18. Frequency of exceedance of the USFDA (2001) action level for heptachlor + heptachlor epoxide (300 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	0 of 2 (0%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**0 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**0 of 2 (0%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**0 of 78 (0%)**

WW = wet weight.

Table 19. Frequency of exceedance of the USFDA (2001) action level for chlordane (300 µg/kg WW) in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	1 of 2 (50%)	0 of 1 (0%)	0 of 7 (0%)	0 of 4 (0%)	0 of 2 (0%)	0 of 2 (0%)	0 of 4 (0%)	0 of 14 (0%)	0 of 14 (0%)	0 of 7 (0%)	**1 of 58 (0%)**
Channel catfish											0 of 1 (0%)	**0 of 1 (0%)**
Goldfish							0 of 1 (0%)		0 of 4 (0%)	0 of 5 (0%)	0 of 6 (0%)	**0 of 16 (0%)**
White sucker										0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 1 (0%)**	**1 of 2 (50%)**	**0 of 1 (0%)**	**0 of 7 (0%)**	**0 of 4 (0%)**	**0 of 2 (0%)**	**0 of 3 (0%)**	**0 of 4 (0%)**	**0 of 18 (0%)**	**0 of 20 (0%)**	**0 of 16 (0%)**	**1 of 78 (1%)**

WW = wet weight.

Table 20. Frequency of exceedance of the USFDA (2001) tolerance level for total PCBs (2000 µg/kg WW)1 in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	0 of 1 (0%)	1 of 2 (50%)	1 of 1 (100%)	7 of 7 (100%)	4 of 4 (100%)	2 of 8 (25%)	2 of 2 (100%)	4 of 4 (100%)	13 of 14 (93%)	14 of 14 (100%)	7 of 7 (100%)	**55 of 64 (86%)**
Channel catfish											1 of 1 (100%)	**1 of 1 (100%)**
Gizzard shad						0 of 2 (0%)						**0 of 2 (0%)**
Goldfish							1 of 1 (100%)		4 of 4 (100%)	5 of 5 (100%)	3 of 6 (50%)	**13 of 16 (81%)**
Sunfish						0 of 1 (0%)						**0 of 1 (0%)**
White sucker										0 of 1 (0%)	1 of 2 (50%)	**1 of 3 (33%)**
All Species	**0 of 1 (0%)**	**1 of 2 (50%)**	**1 of 1 (100%)**	**7 of 7 (100%)**	**4 of 4 (100%)**	**2 of 11 (18%)**	**3 of 3 (100%)**	**4 of 4 (100%)**	**17 of 18 (94%)**	**19 of 20 (95%)**	**12 of 16 (75%)**	**70 of 87 (83%)**

PCBs = polychlorinated biphenyls; WW = wet weight.

[1]The tolerance level for PCBs was refined in 1984 from 5000 µg/kg to 2000 µg/kg.

Table 21. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for mercury in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	Categorical Grouping[2]	1980	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	Group 1	1 of 1 (100%)	1 of 1 (100%)	2 of 7 (29%)	4 of 4 (100%)	8 of 8 (100%)	2 of 2 (100%)	4 of 4 (100%)	14 of 14 (100%)	13 of 14 (93%)	7 of 7 (100%)	**56 of 62 (90%)**
	Group 2			5 of 7 (71%)						1 of 14 (7%)		**6 of 62 (10%)**
	Group 3											
	Group 4											
	Group 5											
Channel catfish	Group 1										1 of 1 (100%)	**1 of 1 (100%)**
	Group 2											
	Group 3											
	Group 4											
	Group 5											
Gizzard shad	Group 1					2 of 2 (100%)						**2 of 2 (100%)**
	Group 2											
	Group 3											
	Group 4											
	Group 5											
Goldfish	Group 1						1 of 1 (100%)		4 of 4 (100%)	5 of 5 (100%)	6 of 6 (100%)	**16 of 16 (100%)**
	Group 2											
	Group 3											
	Group 4											
	Group 5											

Table 21. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for mercury in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	Categorical Grouping[2]	1980	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Pumpkinseed	Group 1				1 of 1 (100%)							**1 of 1 (100%)**
	Group 2											
	Group 3											
	Group 4											
	Group 5											
Sunfish	Group 1					1 of 1 (100%)						**1 of 1 (100%)**
	Group 2											
	Group 3											
	Group 4											
	Group 5											
White sucker	Group 1									1 of 1 (100%)	2 of 2 (100%)	**3 of 3 (100%)**
	Group 2											
	Group 3											
	Group 4											
	Group 5											
All Species	**Group 1**	**1 of 1 (100%)**	**1 of 1 (100%)**	**2 of 7 (29%)**	**5 of 5 (100%)**	**11 of 11 (100%)**	**3 of 3 (100%)**	**4 of 4 (100%)**	**18 of 18 (100%)**	**19 of 20 (95%)**	**16 of 16 (100%)**	**80 of 86 (93%)**
	Group 2			**5 of 7 (71%)**						**1 of 20 (5%)**		**6 of 86 (7%)**
	Group 3											
	Group 4											
	Group 5											

[1]Source: Stahl and Simon 2000.

[2]See Table 4 for a listing of the selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory; See Table 54 for the recommendation regarding consumption of tissues for each categorical grouping.

Table 22. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for total PCBs in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	Categorical Grouping[2]	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Carp	Group 1												
	Group 2						1 of 8 (13%)						**1 of 64 (2%)**
	Group 3						2 of 8 (25%)			1 of 14 (7%)			**3 of 64 (5%)**
	Group 4	1 of 1 (100%)					3 of 8 (38%)						**4 of 64 (6%)**
	Group 5		2 of 2 (100%)	1 of 1 (100%)	7 of 7 (100%)	4 of 4 (100%)	2 of 8 (25%)	2 of 2 (100%)	4 of 4 (100%)	13 of 14 (93%)	14 of 14 (100%)	7 of 7 (100%)	**56 of 64 (88%)**
Channel catfish	Group 1												
	Group 2												
	Group 3												
	Group 4												
	Group 5											1 of 1 (100%)	**1 of 1 (100%)**
Gizzard shad	Group 1												
	Group 2						1 of 2 (50%)						**1 of 2 (50%)**
	Group 3						1 of 2 (50%)						**1 of 2 (50%)**
	Group 4												
	Group 5												

Table 22. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for total PCBs in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	Categorical Grouping[2]	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
Goldfish	Group 1												
	Group 2												
	Group 3											1 of 6 (17%)	**1 of 16 (6%)**
	Group 4											1 of 6 (17%)	**1 of 16 (6%)**
	Group 5							1 of 1 (100%)		4 of 4 (100%)	5 of 5 (100%)	4 of 6 (67%)	**14 of 16 (88%)**
Sunfish	Group 1												
	Group 2												
	Group 3						1 of 1 (100%)						**1 of 1 (100%)**
	Group 4												
	Group 5												
White sucker	Group 1												
	Group 2												
	Group 3										1 of 1 (100%)	1 of 2 (50%)	**2 of 3 (67%)**
	Group 4												
	Group 5											1 of 2 (50%)	**1 of 3 (33%)**

Table 22. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for total PCBs in fish tissues from the Grand Calumet River/Indiana Harbor Canal.

Species	Categorical Grouping[2]	1980	1982	1984	1986	1987	1988	1990	1992	1994	1996	2000	All Years
All Species	**Group 1**												
	Group 2						**2 of 11 (18%)**						**2 of 87 (2%)**
	Group 3						**4 of 11 (36%)**			**1 of 18 (6%)**	**1 of 20 (5%)**	**2 of 16 (13%)**	**8 of 87 (9%)**
	Group 4	**1 of 1 (100%)**					**3 of 11 (27%)**					**1 of 16 (6%)**	**5 of 87 (6%)**
	Group 5		**2 of 2 (100%)**	**1 of 1 (100%)**	**7 of 7 (100%)**	**4 of 4 (100%**	**2 of 11 (18%)**	**3 of 3 (100%)**	**4 of 4 (100%)**	**17 of 18 (94%)**	**19 of 20 (95%)**	**13 of 16 (69%)**	**72 of 87 (83%)**

PCBs = polychlorinated biphenyls.

[1]Source: Stahl and Simon 2000.
[2]See Table 4 for a listing of the selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory; See Table 54 for the recommendation regarding consumption of tissues for each categorical grouping.

Table 23. Frequency of exceedance of the USFDA (2001) action level for mercury (1.0 mg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)	0 of 14 (0%)	**0 of 17 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 17 (0%)**	**0 of 21 (0%)**

WW = wet weight.

Table 24. Frequency of exceedance of the USFDA (2001) action level for aldrin (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

WW = wet weight.

Table 25. Frequency of exceedance of the USFDA (2001) action level for dieldrin (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

WW = wet weight.

Table 26. Frequency of exceedance of the USFDA (2001) action level for aldrin + dieldrin (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	1986	1997	All Years
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

WW = wet weight.

Table 27. Frequency of exceedance of the USFDA (2001) action level for sum DDD (5000 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)	0 of 7 (0%)	**0 of 10 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 10 (0%)**	**0 of 14 (0%)**

Sum DDD = *p,p'*-DDD + *o,p'*-DDD; WW = wet weight.

Table 28. Frequency of exceedance of the USFDA (2001) action level for sum DDE (5000 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	1986	1997	All Years
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

Sum DDE = *p,p*'-DDE + *o,p*'-DDE; WW = wet weight.

Table 29. Frequency of exceedance of the USFDA (2001) action level for sum DDT (5000 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

Sum DDT = *p,p*'-DDT + *o,p*'-DDT; WW = wet weight.

Table 30. Frequency of exceedance of the USFDA (2001) action level for total DDT (5000 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)	0 of 7 (0%)	**0 of 10 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 10 (0%)**	**0 of 14 (0%)**

Total DDT = *p,p*'-DDT, *o,p*'-DDT, *p,p*'-DDE, *o,p*'-DDE, *p,p*'-DDD, and *o,p*'-DDD; WW = wet weight.

Table 31. Frequency of exceedance of the USFDA (2001) action level for heptachlor (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	1986	1997	All Years
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

WW = wet weight.

Table 32. Frequency of exceedance of the USFDA (2001) action level for heptachlor epoxide (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	1986	1997	All Years
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

WW = wet weight.

Table 33. Frequency of exceedance of the USFDA (2001) action level for heptachlor + heptachlor epoxide (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	**1986**	**1997**	**All Years**
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)		**0 of 3 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 3 (0%)**	**0 of 7 (0%)**

WW = wet weight.

Table 34. Frequency of exceedance of the USFDA (2001) action level for chlordane (300 µg/kg WW) in fish tissues from the Grand Calumet River Lagoons.

Species	1986	1997	All Years
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)	0 of 6 (0%)	**0 of 9 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 9 (0%)**	**0 of 13 (0%)**

WW = wet weight.

Table 35. Frequency of exceedance of the USFDA (2001) tolerance level for total PCBs (2000 µg/kg WW)[1] in fish tissues from the Grand Calumet River Lagoons.

Species	1986	1997	All Years
Bluegill		0 of 1 (0%)	**0 of 1 (0%)**
Carp	0 of 3 (0%)	0 of 18 (0%)	**0 of 21 (0%)**
Largemouth bass	0 of 1 (0%)	0 of 2 (0%)	**0 of 3 (0%)**
All Species	**0 of 4 (0%)**	**0 of 21 (0%)**	**0 of 25 (0%)**

PCBs = polychlorinated biphenyls; WW = wet weight.

[1]The tolerance level for PCBs was refined in 1984 from 5000 µg/kg to 2000 µg/kg.

Table 36. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for mercury in fish tissues from the Grand Calumet River Lagoons.

Species	Categorical Grouping[2]	1986	1997	All Years
Bluegill	Group 1		1 of 1 (100%)	**1 of 1 (100%)**
	Group 2			
	Group 3			
	Group 4			
	Group 5			
Carp	Group 1	3 of 3 (100%)	11 of 14 (79%)	**14 of 17 (82%)**
	Group 2		3 of 14 (21%)	**3 of 17 (18%)**
	Group 3			
	Group 4			
	Group 5			
Largemouth bass	Group 1	1 of 1 (100%)	2 of 2 (100%)	**3 of 3 (100%)**
	Group 2			
	Group 3			
	Group 4			
	Group 5			
All Species	**Group 1**	**4 of 4 (100%)**	**14 of 17 (82%)**	**18 of 21 (86%)**
	Group 2		**3 of 17 (18%)**	**3 of 21 (14%)**
	Group 3			
	Group 4			
	Group 5			

[1]Source: Stahl and Simon 2000.

[2]See Table 4 for a listing of the selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory; See Table 54 for the recommendation regarding consumption of tissues for each categorical grouping.

Table 37. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for total PCBs in fish tissues from the Grand Calumet River Lagoons.

Species	Categorical Grouping[2]	1986	1997	All Years
Bluegill	Group 1			
	Group 2			
	Group 3		1 of 1 (100%)	**1 of 1 (100%)**
	Group 4			
	Group 5			
Carp	Group 1			
	Group 2		1 of 18 (6%)	**1 of 21 (5%)**
	Group 3	3 of 3 (100%)	16 of 18 (89%)	**19 of 21 (90%)**
	Group 4		1 of 18 (6%)	**1 of 21 (5%)**
	Group 5			
Largemouth bass	Group 1			
	Group 2		1 of 2 (50%)	**1 of 3 (33%)**
	Group 3	1 of 1 (100%)	1 of 2 (50%)	**2 of 3 (67%)**
	Group 4			
	Group 5			
All Species	**Group 1**			
	Group 2		**2 of 21 (10%)**	**2 of 25 (8%)**
	Group 3	**4 of 4 (100%)**	**18 of 21 (86%)**	**22 of 25 (88%)**
	Group 4		**1 of 21 (5%)**	**1 of 25 (4%)**
	Group 5			

PCBs = polychlorinated biphenyls.

[1]Source: Stahl and Simon 2000.
[2]See Table 4 for a listing of the selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory; See Table 54 for the recommendation regarding consumption of tissues for each categorical grouping.

Table 38. Frequency of exceedance of the USFDA (2001) action level for mercury (1.0 mg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 5 (0%)	0 of 1 (0%)	**0 of 6 (0%)**
Gizzard shad	0 of 6 (0%)	0 of 1 (0%)	**0 of 7 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Sunfish	0 of 1 (0%)		**0 of 1 (0%)**
Yellow perch	0 of 3 (0%)		**0 of 3 (0%)**
All Species	**0 of 17 (0%)**	**0 of 4 (0%)**	**0 of 21 (0%)**

WW = wet weight.

Table 39. Frequency of exceedance of the USFDA (2001) action level for aldrin (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 40. Frequency of exceedance of the USFDA (2001) action level for dieldrin (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	**1988**	**1996**	**All Years**
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 41. Frequency of exceedance of the USFDA (2001) action level for aldrin + dieldrin (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 42. Frequency of exceedance of the USFDA (2001) action level for sum DDD (5000 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

Sum DDD = *p,p'*-DDD + *o,p'*-DDD; WW = wet weight.

Table 43. Frequency of exceedance of the USFDA (2001) action level for sum DDE (5000 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

Sum DDE = *p,p'*-DDE + *o,p'*-DDE; WW = wet weight.

Table 44. Frequency of exceedance of the USFDA (2001) action level for sum DDT (5000 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

Sum DDT = *p,p'*-DDT + *o,p'*-DDT; WW = wet weight.

Table 45. Frequency of exceedance of the USFDA (2001) action level for total DDT (5000 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	**1988**	**1996**	**All Years**
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

Total DDT = *p,p'*-DDT, *o,p'*-DDT, *p,p'*-DDE, *o,p'*-DDE, *p,p'*-DDD, and *o,p'*-DDD; WW = wet weight.

Table 46. Frequency of exceedance of the USFDA (2001) action level for heptachlor (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 47. Frequency of exceedance of the USFDA (2001) action level for heptachlor epoxide (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 48. Frequency of exceedance of the USFDA (2001) action level for heptachlor + heptachlor epoxide (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 49. Frequency of exceedance of the USFDA (2001) action level for chlordane (300 µg/kg WW) in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	0 of 2 (0%)	0 of 1 (0%)	**0 of 3 (0%)**
Gizzard shad		0 of 1 (0%)	**0 of 1 (0%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Yellow perch	0 of 2 (0%)		**0 of 2 (0%)**
All Species	**0 of 6 (0%)**	**0 of 4 (0%)**	**0 of 10 (0%)**

WW = wet weight.

Table 50. Frequency of exceedance of the USFDA (2001) tolerance level for total PCBs (2000 µg/kg WW)[1] in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	1988	1996	All Years
Brown trout		0 of 2 (0%)	**0 of 2 (0%)**
Carp	2 of 5 (40%)	1 of 1 (100%)	**3 of 6 (50%)**
Gizzard shad	0 of 7 (0%)	1 of 1 (100%)	**1 of 8 (13%)**
Longnose sucker	0 of 2 (0%)		**0 of 2 (0%)**
Sunfish	0 of 1 (0%)		**0 of 1 (0%)**
Yellow perch	0 of 3 (0%)		**0 of 3 (0%)**
All Species	**2 of 18 (11%)**	**2 of 4 (50%)**	**4 of 22 (18%)**

PCBs = polychlorinated biphenyls; WW = wet weight.

[1]The tolerance level for PCBs was refined in 1984 from 5000 µg/kg to 2000 µg/kg.

Table 51. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for mercury in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	Categorical Grouping[2]	1988	1996	All Years
Brown trout	Group 1		2 of 2 (100%)	**2 of 2 (100%)**
	Group 2			
	Group 3			
	Group 4			
	Group 5			
Carp	Group 1	2 of 5 (40%)	1 of 1 (100%)	**3 of 6 (50%)**
	Group 2	3 of 5 (60%)		**3 of 6 (50%)**
	Group 3			
	Group 4			
	Group 5			
Gizzard shad	Group 1	6 of 6 (100%)	1 of 1 (100%)	**7 of 7 (100%)**
	Group 2			
	Group 3			
	Group 4			
	Group 5			
Longnose sucker	Group 1	1 of 2 (50%)		**1 of 2 (50%)**
	Group 2	1 of 2 (50%)		**1 of 2 (50%)**
	Group 3			
	Group 4			
	Group 5			
Sunfish	Group 1	1 of 1 (100%)		**1 of 1 (100%)**
	Group 2			
	Group 3			
	Group 4			
	Group 5			
Yellow perch	Group 1	3 of 3 (100%)		**3 of 3 (100%)**
	Group 2			
	Group 3			
	Group 4			
	Group 5			
All Species	**Group 1**	**13 of 17 (76%)**	**4 of 4 (100%)**	**17 of 21 (81%)**
	Group 2	**4 of 17 (24%)**		**4 of 21 (19%)**
	Group 3			
	Group 4			
	Group 5			

[1]Source: Stahl and Simon 2000.
[2]See Table 4 for a listing of the selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory; See Table 54 for the recommendation regarding consumption of tissues for each categorical grouping.

Table 52. Frequency of exceedance of the Indiana State Department of Health threshold levels[1] for total PCBs in fish tissues from Indiana Harbor and nearshore areas of Lake Michigan.

Species	Categorical Grouping[2]	1988	1996	All Years
Brown trout	Group 1			
	Group 2			
	Group 3		1 of 2 (50%)	**1 of 2 (50%)**
	Group 4		1 of 2 (50%)	**1 of 2 (50%)**
	Group 5			
Carp	Group 1			
	Group 2			
	Group 3	2 of 5 (40%)		**2 of 6 (33%)**
	Group 4	1 of 5 (20%)		**1 of 6 (17%)**
	Group 5	2 of 5 (40%)	1 of 1 (100%)	**3 of 6 (50%)**
Gizzard shad	Group 1			
	Group 2	4 of 7 (57%)		**4 of 8 (50%)**
	Group 3	2 of 7 (29%)		**2 of 8 (25%)**
	Group 4	1 of 7 (14%)		**1 of 8 (13%)**
	Group 5		1 of 1 (100%)	**1 of 8 (13%)**
Longnose sucker	Group 1	1 of 2 (50%)		**1 of 2 (50%)**
	Group 2			
	Group 3	1 of 2 (50%)		**1 of 2 (50%)**
	Group 4			
	Group 5			
Sunfish	Group 1			
	Group 2			
	Group 3	1 of 1 (100%)		**1 of 1 (100%)**
	Group 4			
	Group 5			
Yellow perch	Group 1	2 of 3 (67%)		**2 of 3 (67%)**
	Group 2			
	Group 3	1 of 3 (33%)		**1 of 3 (33%)**
	Group 4			
	Group 5			
All Species	**Group 1**	**3 of 18 (17%)**		**3 of 22 (14%)**
	Group 2	**4 of 18 (22%)**		**4 of 22 (18%)**
	Group 3	**7 of 18 (39%)**	**1 of 4 (25%)**	**8 of 22 (36%)**
	Group 4	**2 of 18 (11%)**	**1 of 4 (25%)**	**3 of 22 (14%)**
	Group 5	**2 of 18 (11%)**	**2 of 4 (50%)**	**4 of 22 (18%)**

PCBs = polychlorinated biphenyls.

[1]Source: Stahl and Simon 2000

[2]See Table 4 for a listing of the selected thresholds for tissue chemistry established to support the development of the Indiana Fish Consumption Advisory; See Table 54 for the recommendation regarding consumption of tissues for each categorical grouping.

Table 53. A retrospective on the establishment of fish consumption advisories in Indiana.

Year	Action	Reference
1972	Indiana Department of Natural Resources initiated a sampling and analysis program for fish tissue (now referred to as the Tissue Contaminant Monitoring Program) to study the accumulation of chemical contaminants in fish tissues.	Lee Bridges (IDEM. Indianapolis, Indiana. Personal communication, 2001)
1977	Indiana State Board of Health (now the Indiana State Department of Health) recommended that lake trout from Lake Michigan not be consumed due to elevated levels of contaminants in fish tissues.	Lee Bridges (L. Bridges. IDEM. Indianapolis, Indiana. Personal communication 2001)
1983	Indiana State Board of Health (now the Indiana State Department of Health) recommended that consumption of coho salmon, brown trout, and steelhead trout from Lake Michigan be restricted to no more than one meal per week due to elevated levels of contaminants in fish tissues.	Lee Bridges (L. Bridges. IDEM. Indianapolis, Indiana. Personal communication 2001)
1984	U.S. Food & Drug Administration changed the PCB Tolerance Level for fish tissue from 5000 μg/kg to 2000 μg/kg.	ISBH 1985b
1985	Fish Consumption Advisory classification system is refined to consider fish length and classified according to a three advisory group system.	Lee Bridges, personal communication (2001); ISBH 1985b
1985	The four states bordering Lake Michigan (Illinois, Indiana, Michigan and Wisconsin) agree to share and pool analytical laboratory data on fish tissue contaminant concentrations.	ISBH 1985a
1985	Consumers advised to not eat brown trout, carp and lake trout greater than 25 inches in length caught in Lake Michigan.	ISBH 1985a
1986	Consumers advised to not eat fish from the WBGCR, the EBGCR downstream of the Marquette Park Lagoons, the Indiana Harbor Ship Canal (including Lake George branch) and, Indiana Harbor.	ISBH 1986
1987	The four states bordering Lake Michigan (Illinois, Indiana, Michigan and Wisconsin) released the first joint consumption advisory for fish taken from all Great Lakes waters.	ISBH 1987
until 1995	Consumers advised that there are not consumption advisories in effect for undesignated species in named waterways and all waterways not listed in the advisory.	ISBH, IDEM and IDNR 1989
1993	The Great Lakes Fish Consumption Advisory Task Force established a 'Health Protection Value' of 3.5 μg/day for PCBs and developed five consumption categories based on this value.	Anderson *et al.* 1993

Table 53. A retrospective on the establishment of fish consumption advisories in Indiana.

Year	Action	Reference
1995	The Great Lakes Protocol for evaluating PCB contamination in fish tissue was implemented (i.e., used to establish FCAs). Other COPCs are evaluated based on USFDA Action Levels and by evaluating published recommended reference doses.	Stahl and Simon 2000; IDNR 1995
1995	A statewide advisory restricting the consumption of common carp is issued statewide: "no consumption" for common carp greater than 25 inches in length; "no consumption" for sensitive populations for common carp greater than 15 inches in length; consumption restrictions for common carp less than 25 inches in length.	IDNR 1995
1995	Fish Consumption Advisories group classification system is refined from three to five advisory groups.	IDNR 1995
1995	All consumers advised to limit consumption to one meal per week for undesignated species in named waterways and all waterways not listed in the advisory.	IDNR 1995
1996	Fish Consumption Advisories group classification system is refined to include the "bump up" to afford added protection for the sensitive population (women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15).	Stahl and Simon 2000
1996	Implemented a risk-based approach similar to the Great Lakes Protocol, for evaluating mercury contamination in fish tissue. Other COPCs are evaluated using the USFDA action levels and published reference doses.	Stahl and Simon 2000
1998	Indiana Department of Environmental Management's Office of Water commissioned Purdue University to conduct two fish consumption studies of Indiana anglers (Sheaffer et al. 1999, Williams et al. 2000).	Stahl and Simon 2000
2000	A draft document recommending a HPV of 0.15 mg/kg-day for total chlordane is reviewed by state health agencies and USEPA authorities.	Stahl and Simon 2000

WBGCR = West Branch of the Grand Calumet River; EBGCR = East Branch of the Grand Calumet River;
PCBs = polychlorinated biphenyls; USFDA = United States Food and Drug Administration; FCA = fish consumption advisory;
COPC = chemical of potential concern; USEPA = United States Environmental Protection Agency; HPV = health protection value.

Table 54. Criteria for triggering fish consumption advisories in Indiana.

Year	Categorical Grouping	Triggering Criteria	Recommendation Regarding Consumption of Tissues
1985 - 1994	Group 1	90% or more of the fish tested in Group 1 met USFDA action levels.	Eating Group 1 fish poses the lowest risk of exposure to contaminants.
	Group 2	One or more contaminants were found to be above the USFDA action level in 50% or more of the fish tested in Group 2.	Sensitive populations[1] should not eat these fish. Others should limit consumption to 1 meal per week and heed the preparation and cooking recommendations.
	Group 3	One or more contaminants were found to be above the USFDA action levels in 90% or more of the fish tested in Group 3.	Do not consume.
1995 - 2000	Group 1	COPC Levels < Group 1 Thresholds[2]	Unlimited consumption.
	Group 2	COPC Levels > Group 1 Thresholds and < Group 3 Thresholds	Restrict consumption to one meal per week for the general population, and one meal per month for sensitive populations.
	Group 3	COPC Levels > Group 2 Thresholds and < Group 4 Thresholds	Restrict consumption to one meal per month for the general population, and sensitive populations do not eat.
	Group 4	COPC Levels > Group 3 Thresholds and < Group 5 Thresholds	Restrict consumption to one meal every two months for the general population, and sensitive populations <u>do not</u> eat.
	Group 5	COPC Levels > Group 5 Thresholds	No consumption.

USFDA = United States Food and Drug Administration; COPC = chemical of potential concern; FCA = fish consumption advisory; PCBs = polychlorinated biphenyls.

[1]"general population" = adult males and females; "sensitive population" = women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.
[2]See Table 4 for a listing of the thresholds for PCBs and mercury established to support the development of the Indiana Fish Consumption Advisory.

Table 55. Summary of fish consumption advisories for the GCR/IHC (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

Family/ Common name	Size	1986[1,2]	1989[3]	1990[3]	1991[3]	1992[3]	1993-1994[3]	1994[3]	1995	1996	1997	1998	1999	2000	2001	2002
			Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							
ALL SPECIES	All	●	●	●	●	●	●	●	●[4]	●[4]	●	●	●	●	●	●

GCR/IHC = Grand Calumet River and the Indiana Harbor Canal; ISDH = Indiana State Department of Health; FCA = fish consumption advisory.

[1]ISBH 1986

[2]Advisory specified for the following area: west branch of the Grand Calumet River and the east branch downstream from the Marquette Park Lagoons, and in the Indiana Harbor Ship Canal, including the Lake George branch and Indiana Harbor.

[3]Advisory specified for the following area: Grand Calumet River (east and west branches) and the Indiana Harbor Ship Canal.

[4]Advisories for the GCR/IHC are not specifically listed in the 1995 or 1996 ISDH Indiana Fish Consumption Advisory. It was assumed that the FCAs issued for previous years were still in effect, as there was no indication that the FCAs were withdrawn.

<u>Symbol Legend:</u>

<u>1995-2002</u>

○ Group 1 - Unrestricted consumption. One meal per week for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

⦸ Group 2 - One meal per week (52 meals per year) for adult males and females. One meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

⊗ Group 3 - One meal per month (12 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat.

⊙ Group 4 - One meal every 2 months (6 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat.

● Group 5 - No consumption (DO NOT EAT)

<u>1985-1994</u>

○ Group 1 - No consumption advisory is in effect.

□ Group 2 - Adult men and women not of child-bearing age should consume no more than 1 meal per week consisting of up to one-half pound of flesh of designated species from named waterways. Women of child-bearing age and children under the age of 18 should not consume any of the fish listed in Group 2.

● Group 3 - No one should eat designated species from named waterways.

Table 56. Substances responsible for the fish consumption advisories that have been issued for the Assessment Area (ISBH 1985a; 1985b; 1986; 1987; ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002).

Year	GCR/IHC	GCRL	IH/LM
1985	No advisory	No advisory	PCBs, chlordane, dieldrin and DDT
1986	PCBs	No advisory	PCBs, chlordane, dieldrin and DDT
1987	1986 Advisory not modified or withdrawn[1]	No advisory	PCBs
1988	1986 Advisory not modified or withdrawn[1]	No advisory	1987 Advisory not modified or withdrawn[1]
1989	PCBs	No advisory	PCBs, chlordane, dieldrin, and DDT
1990	PCBs	No advisory	PCBs, chlordane, dieldrin, and DDT
1991	Contaminants of concern not specified	No advisory	Contaminants of concern not specified
1992	Contaminants of concern not specified	No advisory	Contaminants of concern not specified
1993	Contaminants of concern not specified	No advisory	Contaminants of concern not specified
1994	Contaminants of concern not specified	No advisory	Contaminants of concern not specified
1995	1994 Advisory not modified or withdrawn[1]	No advisory	Contaminants of concern not specified
1996	1994 Advisory not modified or withdrawn[1]	PCBs	PCBs, mercury
1997	PCBs, mercury	PCBs	PCBs, mercury
1998	PCBs, mercury	PCBs	PCBs, mercury
1999	PCBs, mercury	PCBs	PCBs, mercury
2000	PCBs, mercury	PCBs	PCBs, mercury
2001	PCBs, mercury	PCBs	PCBs, mercury
2002	PCBs, mercury	PCBs	PCBs, mercury

PCBs = polychlorinated biphenyls; GCR/IHC = Grand Calumet River; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan.

[1]Advisories are not specifically listed in the Indiana Fish Consumption Advisory. It was assumed that the FCAs issued for previous years were still in effect, as there was no indication that the FCAs were withdrawn.

Table 57. Summary of fish consumption advisories that have been issued for the Assessment Area (ISBH 1985a; 1985b; 1986; 1987; ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; each ● indicates that a FCA was issued).

	Year/Geographic Area																																								
	1977[2]	1983[2]	1985	1986		1987	1989		1990		1991		1992		1993-1994		1994		1995		1996			1997			1998			1999			2000			2001			2002		
Family/Common Name (*Scientific Name*)[1]	IH/LM	IH/LM	IH/LM	IH/LM	GCR/IHC	IH/LM	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC
All Species					●			●		●		●		●		●		●		●			●			●			●			●			●			●			●
CYPRINIDAE																																									
Carp (*Cyprinus carpio*)			●	●		●	●		●		●		●		●		●		●		●	●		●	●		●	●		●	●		●	●		●	●		●	●	
Golden shiner (*Notemigonus crysoleucas*)																					●			●			●														
Goldfish (*Carassius auratus*)																					●			●			●														
CENTRARCHIDAE																																									
Black crappie (*Pomoxis nigromaculatus*)																					●			●			●			●			●			●			●		
Bluegill (*Lepomis macrochirus*)																														●	●		●	●		●	●		●	●	
Largemouth bass (*Micropterus salmoides*)																					●	●		●	●		●	●		●	●		●	●		●	●		●	●	
Rock bass (*Ambloplites rupestris*)																														●			●			●			●		
Smallmouth bass (*Micropterus dolomieui*)																														●			●			●			●		

Table 57. Summary of fish consumption advisories that have been issued for the Assessment Area (ISBH 1985a; 1985b; 1986; 1987; ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002;each ● indicates that a FCA was issued).

Year/Geographic Area	1977[2]	1983[2]	1985	1986		1987	1989		1990		1991		1992		1993-1994		1994		1995		1996			1997			1998			1999			2000			2001			2002		
Family/Common Name (*Scientific Name*)[1]	IH/LM	IH/LM	IH/LM	IH/LM	GCR/IHC	IH/LM	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC
CATOSTOMIDAE																																									
Blue sucker (*Cycleptus elongatus*)																			●																						
Carpsuckers (*Carpiodes velifer*)																			●																						
Longnose sucker (*Catostomus catostomus*)																			●		●			●			●			●			●			●			●		
Quillback (*Carpiodes cyprinus*)																														●			●			●			●		
Silver redhorse (*Moxostoma anisurum*)																														●			●			●			●		
Spotted sucker (*Minytrema melanops*)																			●																						
White sucker (*Catostomus commersoni*)																			●		●			●			●			●			●			●			●		
PERCIDAE																																									
Walleye (*Stizostedion vitreum*)																			●		●			●			●			●			●			●			●		
Yellow Perch (*Perca flavescens*)																														●			●			●			●		

Table 57. Summary of fish consumption advisories that have been issued for the Assessment Area (ISBH 1985a; 1985b; 1986; 1987; ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002;each ● indicates that a FCA was issued).

Family/Common Name (*Scientific Name*)[1]	Year/Geographic Area																																								
	1977[2]	1983[2]	1985	1986		1987	1989		1990		1991		1992		1993-1994		1994		1995		1996			1997			1998			1999			2000			2001			2002		
	IH/LM	IH/LM	IH/LM	IH/LM	GCR/IHC	IH/LM	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC
ICTALURIDAE																																									
Catfish (*Ictalurus* sp.)						●	●		●		●		●		●		●				●			●			●			●											
Channel catfish (*Ictalurus punctatus*)																			●														●			●			●		
SCIAENIDAE																																									
Freshwater drum (*Aplodinotus grunniens*)																											●			●			●			●			●		
GOBIIDAE																																									
Round goby (*Neogobius melanostomus*)																														●			●			●			●		
SALMONIDAE																																									
Bloater (*Coregonus hoyi*)																											●			●			●			●			●		
Brook trout (Salvelinus fontinalis)																			●		●			●			●			●			●			●			●		
Brown trout (Salmo trutta)		●	●	●		●	●		●		●		●		●		●		●		●			●			●			●			●			●			●		
Chinook salmon (*Oncorhynchus tschawytscha*)						●	●		●		●		●		●		●		●		●			●			●			●			●			●			●		

Table 57. Summary of fish consumption advisories that have been issued for the Assessment Area (ISBH 1985a; 1985b; 1986; 1987; ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002;each ● indicates that a FCA was issued).

	Year/Geographic Area																																								
	1977[2]	1983[2]	1985	1986		1987	1989		1990		1991		1992		1993-1994		1994		1995		1996			1997			1998			1999			2000			2001			2002		
Family/Common Name (*Scientific Name*)[1]	IH/LM	IH/LM	IH/LM	IH/LM	GCR/IHC	IH/LM	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC	IH/LM	GCRL	GCR/IHC
SALMONIDAE (cont.)																																									
Coho salmon *(Oncorhynchus kisutch)*		●				●	●		●		●		●		●		●		●		●			●			●			●			●			●			●		
Lake trout *(Salvelinus namaycush)*	●		●	●		●	●		●		●		●		●		●		●		●			●			●			●			●			●			●		
Whitefish *(Coregonus clupeaformis)*																			●		●			●			●			●			●			●			●		
Pink salmon *(Oncorhynchus gorbuscha)*																			●		●			●			●			●			●			●			●		
Rainbow trout *(Oncorhynchus mykiss)*																					●			●			●			●			●			●			●		
Steelhead trout *(Oncorhynchus mykiss)*		●																	●								●			●			●			●			●		
ESOCIDAE																																									
Northern pike *(Esox lucius)*																					●			●			●			●			●			●			●		

IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; GCR/IHC = Grand Calumet River and the Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons.

[1]Froese and Pauly 2002
[2]Personal communication with Lee Bridges (IDEM. Indianapolis, Indiana. Personal communication, 2001).

Table 58. Summary of fish consumption advisories for the GCRL[1] (ISDH, IDEM, and IDNR 1996-2002; see the bottom of the table for the symbol legend).

Family/ Common name	Scientific Name[2]	Size	1996	1997	1998	1999	2000	2001	2002
			Unlisted species/waterways: assume Group 2						
CENTRARCHIDAE									
Bluegill	*Lepomis macrochirus*	4-7"				⊗	⊗	⊗	⊗
		7+"				⊙	⊙	⊙	⊙
Largemouth bass	*Micropterus salmoides*	12+"	⊗	⊗	⊗	⊗	⊗	⊗	⊗
CYPRINIDAE									
Carp	*Cyprinus carpio*	15-20"	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		20-25"	⊙	⊙	⊙	⊙	⊙	⊙	⊙
		25+"	●	●	●	●	●	●	●

GCRL = Grand Calumet River Lagoons.

[1]Grand Calumet River Lagoons listed as Marquette Park Lagoons in the Indiana Fish Consumption Advisories.
[2]Froese and Pauly 2002

Symbol Legend:

○ Group 1 - Unrestricted consumption. One meal per week for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

⦸ Group 2 - One meal per week (52 meals per year) for adult males and females. One meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

⊗ Group 3 - One meal per month (12 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat.

⊙ Group 4 - One meal every 2 months (6 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat.

● Group 5 - No consumption (DO NOT EAT)

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

			Lake Michigan								Lake Michigan and Tributaries						Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]						
Family/ Common name	Scientific name[1]	Size	1977[2]	1978-1982	1983[2]	1984	1985[3]	1986[3,4]	1987[3]	1989[5]	1990[5]	1991[5]	1992[5]	1993-1994[5]	1994[5]	1995[5,6]	1996[5]	1997[5]	1998[5]	1999[5]	2000[5]	2001[5]	2002[5]
			Unlisted species/waterways: no assumption							Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							
CYPRINIDAE																							
Carp	*Cyprinus carpio*	All							●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		25+"					●	●															
Golden shiner	*Notemigonus crysoleucas*	3-6"															●[8]	●[8]	●[8]				
Goldfish	*Carassius auratus*	4+"															●[8]	●[8]	●[8]				
CENTRARCHIDAE																							
Black crappie	*Pomoxis nigromaculatus*	7-8"															⊗	⊗	⊗	⊗	⊗	⊗	⊗
		8+"															⊙	⊙	⊙	⊙	⊙	⊙	⊙
Bluegill	*Lepomis macrochirus*	7-8"																		⦸	⦸	⦸	⦸
		8+"																		⊗	⊗	⊗	⊗
Largemouth bass	*Micropterus salmoides*	4-7"															⊗	⊗	⊗	⊗	⊗	⊗	⊗
		7+"															⊙	⊙	⊙	⊙	⊙	⊙	⊙
Rock bass	*Ambloplites rupestris*	8-9"																		⦸	⦸	⦸	⦸
Smallmouth bass	*Micropterus dolomieui*	8-14"																		⦸			
		11-12"																			⊗	⊗	⊗
		12+"																			●	●	●
		14+"																		⊗			

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

			Lake Michigan								Lake Michigan and Tributaries						Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]						
Family/ Common name	**Scientific name[1]**	**Size**	**1977[2]**	**1978-1982**	**1983[2]**	**1984**	**1985[3]**	**1986[3,4]**	**1987[3]**	**1989[5]**	**1990[5]**	**1991[5]**	**1992[5]**	**1993-1994[5]**	**1994[5]**	**1995[5,6]**	**1996[5]**	**1997[5]**	**1998[5]**	**1999[5]**	**2000[5]**	**2001[5]**	**2002[5]**
			Unlisted species/waterways: no assumption							Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							
CATOSTOMIDAE																							
Blue sucker	*Cycleptus elongatus*	8-15"														⊙							
		15-23"														●							
Carpsuckers	*Carpiodes velifer*	8-15"														⊙							
		15-23"														●							
Longnose sucker	*Catostomus catostomus*	8-15"														⊙							
		15-23"														●	⊙	⊙	⊙	⊙	⊙	⊙	⊙
		23+"															●	●	●	●	●	●	●
Quillback	*Carpiodes cyprinus*	20+"																		⊗	⊗	⊗	⊗
Silver redhorse	*Moxostoma anisurum*	25+"																		●	●	●	●
Spotted sucker	*Minytrema melanops*	8-15"														⊙							
		15-23"														●							
White sucker	*Catostomus commersoni*	8-15"														⊙							
		15-23"														●	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		23+"															⊙	⊙	⊙	⊙	⊙	⊙	⊙

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

Family/ Common name	Scientific name[1]	Size	1977[2]	1978-1982	1983[2]	1984	1985[3]	1986[3,4]	1987[3]	1989[5]	1990[5]	1991[5]	1992[5]	1993-1994[5]	1994[5]	1995[5,6]	1996[5]	1997[5]	1998[5]	1999[5]	2000[5]	2001[5]	2002[5]
			Lake Michigan								Lake Michigan and Tributaries						Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]						
			Unlisted species/waterways: no assumption							Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							
PERCIDAE																							
Walleye	*Stizostedion vitreum*	17-26"														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		26+"														⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
Yellow perch	*Perca flavescens*	7-10"																				⊘	⊘
		10+"																		⊘	⊘		
ICTALURIDAE																							
Catfish	*Ictalurus sp.*	All							●	●	●	●	●	●	●		●	●	●	●			
Channel catfish	*Ictalurus punctatus*	All																			●	●	●
		13-17"														●							
		17+"														●							
SCIAENIDAE																							
Freshwater drum	*Aplodinotus grunniens*	14-17"																			⊗	⊗	⊗
		17-20"																			⊙	⊙	⊙
		17-22"																	⊗	⊗			
		20+"																			●	●	●
		22+"																	⊙	⊙			
GOBIIDAE																							
Round goby	*Neogobius melanostomus*	3-4"																		⊘	⊘	⊘	⊘
		4+"																		⊗	⊗	⊗	⊗

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

			Lake Michigan								Lake Michigan and Tributaries						Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]						
Family/ Common name	Scientific name[1]	Size	1977[2]	1978-1982	1983[2]	1984	1985[3]	1986[3,4]	1987[3]	1989[5]	1990[5]	1991[5]	1992[5]	1993-1994[5]	1994[5]	1995[5,6]	1996[5]	1997[5]	1998[5]	1999[5]	2000[5]	2001[5]	2002[5]
			Unlisted species/waterways: no assumption							Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							
SALMONIDAE																							
Bloater	*Coregonus hoyi*	10+																	⊗	⊗	⊗	⊗	⊗
Brook trout	*Salvelinus fontinalis*	All														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
Brown trout	*Salmo trutta*	All			□	□[9]																	
		Up to 18"														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		Up to 23"							□	□	□	□	□	□	□								
		18-27"														⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
		23+"							●	●	●	●	●	●	●								
		25+"					●	●															
		27+"														●	●	●	●	●	●	●	●
Chinook salmon	*Oncorhynchus tschawytscha*	Up to 26"														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		21-32"							□	□	□	□	□	□	□								
		26-30"																	⊙	⊙	⊙	⊙	⊙
		26+"														⊙	⊙	⊙					
		30+"																	●	●	●	●	●
		32+"							●	●	●	●	●	●	●								
Coho salmon	*Oncorhynchus kisutch*	All			□	□[9]																	
		17-28"														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		26+"							□	□	□	□	□	□	□								
		28+"														⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

			Lake Michigan								**Lake Michigan and Tributaries**						**Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]**						
Family/ Common name	**Scientific name[1]**	**Size**	**1977[2]**	**1978-1982**	**1983[2]**	**1984**	**1985[3]**	**1986[3,4]**	**1987[3]**	**1989[5]**	**1990[5]**	**1991[5]**	**1992[5]**	**1993-1994[5]**	**1994[5]**	**1995[5,6]**	**1996[5]**	**1997[5]**	**1998[5]**	**1999[5]**	**2000[5]**	**2001[5]**	**2002[5]**
			Unlisted species/waterways: no assumption							**Unlisted species/waterways: assume Group 1**						**Unlisted species/waterways: assume Group 2**							
Lake trout	*Salvelinus namaycush*	All	●	●[9]																			
		Up to 21"														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
		20-23"							□	□	□	□	□	□	□								
		21-26"														⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
		23+"							●	●	●	●	●	●	●								
		25+"					●	●															
		26+"														●	●	●	●	●	●	●	●
Whitefish[10]	*Coregonus clupeaformis*	9-12"																	⦸	⦸	⦸	⦸	⦸
		12-20"																	⊗	⊗	⊗	⊗	⊗
		Up to 23"														⊗	⊗	⊗					
		20-24"																	⊙	⊙	⊙	⊙	⊙
		23+"														⊙	⊙	⊙					
		24+"																	●	●	●	●	●
Pink salmon	*Oncorhynchus gorbuscha*	All														⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
Rainbow trout	*Oncorhynchus mykiss*	All																					
		Up to 22"															⊗	⊗	⊗	⊗	⊗	⊗	⊗
		22+"															⊙	⊙	⊙	⊙			
		22-32"																			⊙	⊙	⊙

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

			Lake Michigan								Lake Michigan and Tributaries						Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]						
Family/ Common name	**Scientific name[1]**	**Size**	**1977[2]**	**1978-1982**	**1983[2]**	**1984**	**1985[3]**	**1986[3,4]**	**1987[3]**	**1989[5]**	**1990[5]**	**1991[5]**	**1992[5]**	**1993-1994[5]**	**1994[5]**	**1995[5,6]**	**1996[5]**	**1997[5]**	**1998[5]**	**1999[5]**	**2000[5]**	**2001[5]**	**2002[5]**
			Unlisted species/waterways: no assumption							Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							
Steelhead trout	*Oncorhynchus mykiss*	All			□	□[9]																	
		Up to 22"														⊗							
		22+"														⊙							
		26-32"																	⊙	⊙			
		32+"																	●	●	●	●	●
ESOCIDAE																							
Northern pike	*Esox lucius*	10-14"															⊗	⊗	⊗	⊗	⊗	⊗	⊗
		14+"															⊙	⊙	⊙	⊙	⊙	⊙	⊙

IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; FCA = fish consumption advisory; ISDH = Indiana State Department of Health.

[1]Froese and Pauly 2002
[2]Personal communication with Lee Bridges (IDEM. Indianapolis, Indiana. Personal communication, 2001).
[3]ISBH 1985a; 1985b; 1986; 1987.
[4]The FCA issued in 1986 for the Grand Calumet River and Indiana Harbor Canal also included Indiana Harbor ("all species" classified in Group 5; see Table 55).
[5]ISBH, IDEM, and IDNR 1989; 1990; 1991; ISDH, IDEM, and IDNR 1992; 1993; 1994; 1995; 1996; 1997; 1998; 1999; 2000; 2001; 2002.
[6]Fish Consumption Advisories group classification system is refined from three to five advisory groups.
[7]It was assumed that the FCAs apply directly to nearshore areas of Lake Michigan and tributaries within Lake County.
[8]FCA applies to Lake County only.
[9]Advisories for IH/LM are not specifically listed in the 1978 to 1982 or 1984 ISDH Public Health News bulletin or in the Indiana Fish Consumption Advisory. It was assumed that the FCAs issued for previous years were still in effect, as there was no indication that the FCAs were withdrawn.
[10]Referred to as "Lake Whitefish" in 1998-2002 Fish Consumption Advisories.

Table 59. Summary of fish consumption advisories for the IH/LM (ISBH, IDEM, and IDNR 1989-1991; ISDH, IDEM, and IDNR 1992-2002; see the bottom of the table for the symbol legend).

			Lake Michigan								Lake Michigan and Tributaries						Lake Michigan and Tributaries (Lake, LaPorte & Porter Counties)[7]						
Family/ Common name	Scientific name[1]	Size	1977[2]	1978-1982	1983[2]	1984	1985[3]	1986[3,4]	1987[3]	1989[5]	1990[5]	1991[5]	1992[5]	1993-1994[5]	1994[5]	1995[5,6]	1996[5]	1997[5]	1998[5]	1999[5]	2000[5]	2001[5]	2002[5]
			Unlisted species/waterways: no assumption							Unlisted species/waterways: assume Group 1						Unlisted species/waterways: assume Group 2							

Symbol Legend:

1995-2002

○ Group 1 - Unrestricted consumption. One meal per week for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

⦸ Group 2 - One meal per week (52 meals per year) for adult males and females. One meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15.

⊗ Group 3 - One meal per month (12 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat.

⊙ Group 4 - One meal every 2 months (6 meals per year) for adult males and females. Women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat.

● Group 5 - No consumption (DO NOT EAT)

1985-1994

○ Group 1 - No consumption advisory is in effect.

□ Group 2 - Adult men and women not of child-bearing age should consume no more than 1 meal per week consisting of up to one-half pound of flesh of designated species from named waterways. Women of child-bearing age and children under the age of 18 should not consume any of the fish listed in Group 2.

● Group 3 - No one should eat designated species from named waterways.

Table 60. Summary of COPCs, COCs for each line of evidence, and principal COCs for the GCR/IHC.

List of Chemicals	COPCs[1]	Individual Lines of Evidence: Sediment-associated COC[2]	Tissue-associated COC[3]: USFDA	Tissue-associated COC[3]: ISDH	FCA COC[4]	Principal COC[5]
Metals						
Mercury	✓			✓	✓	✓
Polycyclic Aromatic Hydrocarbons						
Benzene	✓	✓				
Carbazole	✓	✓				
Benz[a]anthracene	✓	✓				
Benzo(b)fluoranthene	✓	✓				
Benzo(k)fluoranthene	✓	✓				
Benzo(a)pyrene	✓	✓				
Chrysene	✓	✓				
Dibenz[a,h]anthracene	✓	✓				
Indeno(1,2,3-cd)pyrene	✓	✓				
Polychlorinated Biphenyls						
Aroclor 1016	✓					
Aroclor 1242	✓	✓				
Aroclor 1248	✓	✓				
Aroclor 1254	✓	✓				
Aroclor 1260	✓	✓				
Total PCBs	✓	✓	✓	✓	✓	✓
Chlorinated Benzenes						
Hexachlorobenzene (HCB)	✓					
Hexachlorobutadiene (HCBD)	✓					
Phthalates						
Bis(2-ethylhexyl)phthalate	✓					
Chlorophenols						
2,4-Dichlorophenol	✓					
2,4,6-Trichlorophenol	✓					
Pentachlorophenol	✓					
Pesticides						
Aldrin	✓					
Dieldrin	✓	✓				
Aldrin + dieldrin	✓					
Chlordane	✓	✓	✓			✓

Table 60. Summary of COPCs, COCs for each line of evidence, and principal COCs for the GCR/IHC.

List of Chemicals	COPCs[1]	Individual Lines of Evidence				Principal COC[5]
		Sediment-associated COC[2]	Tissue-associated COC[3]		FCA COC[4]	
			USFDA	ISDH		
Pesticides (cont.)						
p,p'-DDD	✓	✓				
p,p'-DDE	✓	✓				
p,p'-DDT	✓	✓				
Total DDT	✓					
Endosulfan	✓					
Endrin	✓	✓				
Heptachlor	✓	✓				
Heptachlor epoxide	✓	✓				
Heptachlor + heptachlor epoxide	✓					
Alpha-hexachlorocyclohexane (HCH)	✓					
Beta-HCH	✓	✓				
Technical-HCH	✓					
Lindane (gamma-HCH)	✓	✓				
Dioxins and Furans						
TCDD-TEQ	✓	✓				

COC = contaminant of concern; COPC = chemical of potential concern; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health; FCA = fish consumption advisory; PCB = polychlorinated biphenyls; TCDD-TEQ = tetrachlorodibenzo-*p*- dioxin - toxic equivalents; GCR/IHC = Grand Calumet River and the Indian Harbor Canal.

[1]See Section 1.0 for more information on how COPCs were identified.
[2]Substances that occurred in two or more whole-sediment samples at concentrations in excess of the corresponding chemical benchmark.
[3]Substances that occurred in one or more fish tissue samples at concentrations in excess of the corresponding chemical benchmark (i.e., the tolerance levels or action levels that have been promulgated by the USFDA or the Group 1 threshold levels that have been established by ISDH to support the development of FCAs).
[4]Substances responsible for the issuance of FCAs.
[5]The principal COCs included those COPCs that were identified as substances that had driven a FCA or were present in fish tissues at concentrations above one or more of the selected benchmarks. Substances that exceeded the selected benchmarks for sediment chemistry alone were identified as COCs, but were not considered to be the principal COCs.

Table 61. Summary of COPCs, COCs for each line of evidence, and principal COCs for the GCRL.

List of Chemicals	COPCs[1]	Individual Lines of Evidence				Principal COC[5]
		Sediment-associated COC[2]	Tissue-associated COC[3]		FCA COC[4]	
			USFDA	ISDH		
Metals						
Mercury	✓			✓		✓
Polycyclic Aromatic Hydrocarbons						
Benzene	✓					
Carbazole	✓					
Benz[a]anthracene	✓	✓				
Benzo(b)fluoranthene	✓	✓				
Benzo(k)fluoranthene	✓	✓				
Benzo(a)pyrene	✓	✓				
Chrysene	✓	✓				
Dibenz[a,h]anthracene	✓	✓				
Indeno(1,2,3-cd)pyrene	✓	✓				
Polychlorinated Biphenyls						
Aroclor 1016	✓					
Aroclor 1242	✓	✓				
Aroclor 1248	✓	✓				
Aroclor 1254	✓	✓				
Aroclor 1260	✓	✓				
Total PCBs	✓	✓		✓	✓	✓
Chlorinated Benzenes						
Hexachlorobenzene (HCB)	✓					
Hexachlorobutadiene (HCBD)	✓					
Phthalates						
Bis(2-ethylhexyl)phthalate	✓					
Chlorophenols						
2,4-Dichlorophenol	✓					
2,4,6-Trichlorophenol	✓					
Pentachlorophenol	✓					
Pesticides						
Aldrin	✓					
Dieldrin	✓	✓				
Aldrin + dieldrin	✓					
Chlordane	✓	✓				

Table 61. Summary of COPCs, COCs for each line of evidence, and principal COCs for the GCRL.

List of Chemicals	COPCs[1]	Individual Lines of Evidence: Sediment-associated COC[2]	Tissue-associated COC[3]: USFDA	Tissue-associated COC[3]: ISDH	FCA COC[4]	Principal COC[5]
Pesticides (cont.)						
p,p'-DDD	✓	✓				
p,p'-DDE	✓	✓				
p,p'-DDT	✓	✓				
Total DDT	✓					
Endosulfan	✓					
Endrin	✓	✓				
Heptachlor	✓					
Heptachlor epoxide	✓					
Heptachlor + heptachlor epoxide	✓					
Alpha-hexachlorocyclohexane (HCH)	✓					
Beta-HCH	✓					
Technical-HCH	✓					
Lindane (gamma-HCH)	✓					
Dioxins and Furans						
TCDD-TEQ	✓					

COC = contaminant of concern; COPC = chemical of potential concern; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health; FCA = fish consumption advisory; PCB = polychlorinated biphenyls; TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents; GCRL = Grand Calumet River Lagoons.

[1]See Section 1.0 for more information on how COPCs were identified.
[2]Substances that occurred in two or more whole-sediment samples at concentrations in excess of the corresponding chemical benchmark.
[3]Substances that occurred in one or more fish tissue samples at concentrations in excess of the corresponding chemical benchmark (i.e., the tolerance levels or action levels that have been promulgated by the USFDA or the Group 1 threshold levels that have been established by ISDH to support the development of FCAs).
[4]Substances responsible for the issuance of FCAs.
[5]The principal COCs included those COPCs that were identified as substances that had driven a FCA or were present in fish tissues at concentrations above one or more of the selected benchmarks. Substances that exceeded the selected benchmarks for sediment chemistry alone were identified as COCs, but were not considered to be the principal COCs.

Table 62. Summary of COPCs, COCs for each line of evidence, and principal COCs for IH/LM.

List of Chemicals	COPCs[1]	Individual Lines of Evidence: Sediment-associated COC[2]	Tissue-associated COC[3]: USFDA	Tissue-associated COC[3]: ISDH	FCA COC[4]	Principal COC[5]
Metals						
Mercury	✓			✓	✓	✓
Polycyclic Aromatic Hydrocarbons						
Benzene	✓					
Carbazole	✓					
Benz[a]anthracene	✓	✓				
Benzo(b)fluoranthene	✓					
Benzo(k)fluoranthene	✓	✓				
Benzo(a)pyrene	✓	✓				
Chrysene	✓	✓				
Dibenz[a,h]anthracene	✓	✓				
Indeno(1,2,3-cd)pyrene	✓	✓				
Polychlorinated Biphenyls						
Aroclor 1016	✓					
Aroclor 1242	✓	✓				
Aroclor 1248	✓					
Aroclor 1254	✓					
Aroclor 1260	✓					
Total PCBs	✓	✓	✓	✓	✓	✓
Chlorinated Benzenes						
Hexachlorobenzene (HCB)	✓					
Hexachlorobutadiene (HCBD)	✓					
Phthalates						
Bis(2-ethylhexyl)phthalate	✓					
Chlorophenols						
2,4-Dichlorophenol	✓					
2,4,6-Trichlorophenol	✓					
Pentachlorophenol	✓					
Pesticides						
Aldrin	✓					
Dieldrin	✓				✓	✓
Aldrin + dieldrin	✓					
Chlordane	✓				✓	✓

Table 62. Summary of COPCs, COCs for each line of evidence, and principal COCs for IH/LM.

List of Chemicals	COPCs[1]	Individual Lines of Evidence: Sediment-associated COC[2]	Tissue-associated COC[3]: USFDA	Tissue-associated COC[3]: ISDH	FCA COC[4]	Principal COC[5]
Pesticides (cont)						
p,p'-DDD	✓					
p,p'-DDE	✓					
p,p'-DDT	✓					
Total DDT	✓				✓	✓
Endosulfan	✓					
Endrin	✓					
Heptachlor	✓					
Heptachlor epoxide	✓					
Heptachlor + heptachlor epoxide	✓					
Alpha-hexachlorocyclohexane (HCH)	✓					
Beta-HCH	✓					
Technical-HCH	✓					
Lindane (gamma-HCH)	✓					
Dioxins and Furans						
TCDD-TEQ	✓	✓				

COC = contaminant of concern; COPC = chemical of potential concern; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health; FCA = fish consumption advisory; PCB = polychlorinated biphenyls; TCDD-TEQ = tetrachlorodibenzo-*p*- dioxin - toxic equivalents; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan.

[1]See Section 1.0 for more information on how COPCs were identified.
[2]Substances that occurred in two or more whole-sediment samples at concentrations in excess of the corresponding chemical benchmark.
[3]Substances that occurred in one or more fish tissue samples at concentrations in excess of the corresponding chemical benchmark (i.e., the tolerance levels or action levels that have been promulgated by the USFDA or the Group 1 threshold levels that have been established by ISDH to support the development of FCAs).
[4]Substances responsible for the issuance of FCAs.
[5]The principal COCs included those COPCs that were identified as substances that had driven a FCA or were present in fish tissues at concentrations above one or more of the selected benchmarks. Substances that exceeded the selected benchmarks for sediment chemistry alone were identified as COCs, but were not considered to be the principal COCs.

An Assessment of Injury to Human Uses of Fishery Resources in the Grand Calumet River and Indiana Harbor Canal, the Grand Calumet River Lagoons, and Indiana Harbor and the Nearshore Areas of Lake Michigan

Volume II - Appendices

Prepared for:

U.S. Fish and Wildlife Service
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Appendix 1

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EDUCATION:

Bachelor of Science, Zoology
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University of British Columbia, 1982

SPECIALIZATION:

Principal of MacDonald Environmental Sciences Limited, which was established to provide scientific consulting services in the fields of fisheries and aquatic resource management, stream ecology, environmental quality guidelines and policy development, environmental risk and hazard assessment, and information and technology transfer.

Specialist environmental toxicology and chemistry, ecosystem-based resource management, water quality/water use interactions, and sediment quality assessment.

PROFESSIONAL MEMBERSHIPS:

American Fisheries Society
President Western Division; Past-President, Canadian Aquatic Resources Section; Nominations Committee; Chair, Wetlands Conservation Committee; Newsletter Committee; Membership Committee.

Aquaculture Association of Canada

Association of Professional Biologists of British Columbia

Canadian Association on Water Pollution Research and Control

International Association on Water Pollution Research and Control

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EXPERIENCE:

AQUATIC BIOLOGIST - February 1989 to Present

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Independent consulting on fisheries and aquatic resource management, environmental quality, stream ecology, computer data management, and information and technology transfer. Recent projects have been focussed on the development of water quality guidelines, sediment quality guidelines, tissue residue guidelines, environmental quality monitoring programs, fisheries co-management programs, and the assessment of environmental quality.

WATER QUALITY OBJECTIVES OFFICER - September 1984 to February 1989

Water Quality Branch, Inland Waters, Environment Canada
502 - 1001 West Pender Street, Vancouver, B.C. V6E 2M9

Compilation, management and statistical analysis of existing and new information generated to support the formulation of water quality objectives in waters of significant federal interest; generation of water quality criteria information through toxicological, water quality, and other studies; design and implementation of monitoring programs to assess compliance with water quality objectives; preparation of reports and other publications on information developed to formulate water quality objectives; organization of workshops and information exchange sessions on water quality guidelines and objectives; provision of information and advice to technical committees established to resolve the International Joint Commission reference on the Flathead River.

Supervisor: Dr. D. Valiela, Head Water Quality Objectives Division

TECHNICAL PLANNING COORDINATOR - November 1983 to September 1984

Water Quality Branch, Inland Waters, Environment Canada
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Planning and development of regional water quality programs, including long- and short-term logistics and budgetary requirements and inter-project coordination; planning, organization, expedition, and supervision of special field studies and sampling projects for water quality analysis; pollution surveillance and sediment sampling; planning and implementation on national water quality monitoring programs to assess national trends and conditions.

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Journal/Book Publications

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Helm, R.K., D.D. MacDonald, B. Sinclair, D. Chan, T. Hetherington, A. Chalmers and B.G. Shepherd. 1980. A review of the Nechako River watershed. Enhancement Services Branch, Fisheries and Oceans Canada. 90 pp. + appendices.

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EDUCATION

1974-1975	Bemidji State University, Bemidji, MN
1975-1978	Miami University, Oxford, OH, B.S. Biology Education
1980-1982	Miami University, Oxford, OH, M.S. Zoology
1982-1986	University of Wyoming, Laramie, WY, Ph.D. Zoology and Physiology

PROFESSIONAL CAREER

1977	Undergraduate Teaching Assistant, Vertebrate Zoology, Miami University, Oxford, OH
1978-1980	High School Biology Teacher, Milford Village Schools, Milford, OH
1980-1982	Graduate Teaching Assistant (Limnology, Animal Diversity), Department of Zoology, Miami University, Oxford, OH
1981-1982	Research Assistant with Dr. Robert W. Winner, Department of Zoology, Miami University, Oxford, OH
1982-1983	Graduate Teaching Assistant (Limnology, Lake and Field Ecology, and Human Anatomy and Physiology), Department of Zoology and Physiology, University of Wyoming, Laramie, WY
1983-1986	Research Assistant with Dr. Harold L. Bergman, Department of Zoology and Physiology, University of Wyoming, Laramie, WY
1986-1987	Leader, Invertebrate Toxicology Section, National Fisheries Contaminant Research Center, US Fish and Wildlife Service, Columbia, MO
1987-1996	Leader, Fish and Invertebrate Toxicology Section, National Fisheries Contaminant Research Center/Midwest Science Center/Environmental and Contaminants Research Center/Columbia Environmental Research Center, US Fish and Wildlife Service/National Biological Survey/National Biological Service/US Geological Survey, Columbia, MO
1988-	Research Associate, School of Forestry, Fisheries and Wildlife, University of Missouri, Columbia, MO
1996-	Chief, Aquatic Toxicology Branch, US Geological Survey, Columbia, MO

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PROFESSIONAL SOCIETY MEMBERSHIP AND COMMITTEE ACTIVITIES

Society of Environmental Toxicology and Chemistry (SETAC)
- Nominating Committee (1993)
- Technical Committee (Chair, 1992-1995)
- Short Course Committee (1992-1995)
- Meeting Committee (1992)
- Publications Advisory Council (1995 to present)
- Guest editor for issue 13:12 (1994) of *Environmental Toxicology and Chemistry*
- Coordinating Editor of SETAC Books (1995-2001)
- Editorial Board (1987-1990)
- Board of Directors (National: 1992-1995; 2001 to present)
- Board of Directors (Regional: 1987-1992)
- Liaison to ASTM (1992 to present)
- Membership Committee (Chair, 2001 to present)

American Society for Testing and Materials (ASTM)
- Chair of Committee E47 on Environmental Fate and Effects of Contaminants (1996-2001)
- Chair Subcommittee E47.03 on Sediment Toxicology (1988-1996)
- Subcommittee E47.03 on Sediment Toxicology (1988 to present; Task Groups E1367, E1383, E1391, E1525, E1706)
- Subcommittee E47.01 on Aquatic Toxicology (1988 to present)
- Committee on Standards (1999-2001)
- Subcommittee on the Form and Style Manual (1999-2001)
- Chair of Form and Style Subcommittee for the Committee on Standards (2000-2001)
- Chair Subcommittee E47.03 on Sediment Assessment and Toxicology (2002 to present)

Standards Engineering Society (2002-)

Archives of Environmental Contamination and Toxicology, Editorial Board (1997-)

Environmental Protection Agency Scientific Advisory Boards
- Environmental Effects and Fate Committee - Sediment Criteria Subcommittee member (1988-1996)
- ACQUIRE database review (1994)
- Ecological Risk Assessment colloquium (1994)
- Environmental Effects and Fate Committee - Ammonia Sulfate Subcommittee member (1995)
- National Sediment Inventory (1995 to present)
- Standard Methods Review (Series 835 and 850; 1997)

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National Oceanic and Atmospheric Administration
Cargo Sweeping advisory panel (1994)

Standard Methods
Editorial Board (2000 to present)

JOURNAL REVIEWER

American Society for Testing and Materials Aquatic Toxicology
Archives of Environmental Contamination and Toxicology (Editorial Board)
Canadian Journal of Fisheries and Aquatic Science
Chemosphere
Environmental Toxicology and Chemistry (Editorial Board)
Journal of Great Lakes Research
Journal of the Water Pollution Control Federation

HONORS AND DISTINCTIONS

Eagle Scout (1971)
Magna Cum Laude, Miami University (1978)
Graduate Student Achievement Award, Miami University (1981)
Outstanding Graduate Student in Zoology (awarded by Department of Zoology, Miami University; 1982)
Outstanding Graduate Student (awarded by Phi Sigma, Miami University; 1982)
US Fish and Wildlife Service/National Biological Service Quality Performance Award (awarded for a level IV performance evaluation in 1987, 1989-1994); US Fish and Wildlife Service Special Achievement Award (awarded for a level V performance evaluation in 1988)
Exceptional Service Award, ASTM Committee E47 on Biological Effects and Environmental Fate (1992)
Award for distinguished service on the USEPA GLNPO ARCS project (1993)
Special recognition from SETAC for service as Chair of the Technical Committee 1992-1994 (1994)
Nominated for EPA gold medal for development of standard methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with invertebrates (1994)
Paper by Canfield et al. 1996 in the *Journal of Great Lakes Research* selected as the first runner up for the Chandler-Misener Award for the outstanding paper in the journal in a given year (1997)
Society of Technical Communications competition award of “Excellence” for the book by Ingersoll CG, Dillon T, Biddinger RG, editors. 1997. Ecological risk assessment of contaminated sediment. Pensacola FL: SETAC Press (1998)
USGS on the spot award for serving as an editor on book: Ingersoll CG, Dillon T, Biddinger RG, editors. 1997. Ecological risk assessment of contaminated sediment. Pensacola FL: SETAC Press (1998)

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USGS on the spot award for coordinating research projects associated with the Toxicology Branch (1998)
USGS award for conducting a review of the USGS Water Resources Division NAWQA ecological study plans (1999)
EPA bronze metal for assistance in developing methods for assessing sediment contamination with freshwater invertebrates (1999)
EPA Office of Water team of the quarter (October to December of 1999) for contributions in the development of a methods manual for assessing sediment contamination with freshwater invertebrates (2000)
USGS star award for coordinating research projects associated with the Toxicology Branch (2000)
Society of Technical Communications competition award of “Excellence” for the book by DeFur PL, Crane M, Ingersoll CG, Tattersfield LJ, editors. 1999. Endocrine disruption in invertebrates: Endocrinology, testing, and assessment. Pensacola FL: SETAC Press (2001)
USGS star award for periodically serving as the acting Center Director and for assistance in coordinating the Center review (2001)
ASTM award of appreciation for serving as the Chair of Committee E47 on Biological Effects and Environmental Fate (1996 to 2001)
ASTM service award from the Committee on Standards (2001)
Nominated for the SETAC government service award (2001, 2002)
USGS star award for contribution to the BRD Contaminants Program review (2002)
ASTM Robert J. Painter meritorious award for development of standards (2002)

THESIS AND DISSERTATION

Ingersoll CG. 1982. Effect on *Daphnia pulex* (De Geer) of daily pulse exposures to copper or cadmium. Master's thesis, Miami University, Oxford, OH. 22 p.

Ingersoll CG. 1986. The effects of pH, aluminum, and calcium on survival and growth of brook trout (*Salvelinus fontinalis*) early life stages. Ph.D. thesis, The University of Wyoming, Laramie, WY. 122 p.

PRESENTATIONS

Ingersoll CG, Winner RW. The effect on *Daphnia pulex* of daily, short-term exposures to copper or cadmium. Presented at the 2nd annual meeting of SETAC, Arlington, VA, November 22-25, 1981.

Ingersoll CG, Hlohowskyj I, Mundahl ND. Movements and densities of fantail (*Etheostoma flabellare*), orangethroat (*E. spectabile*), and johnny *(E. nigrum*) darters during spring spawning. Presented at the 63rd annual meeting of the American Society of Ichthyologists and Herpetologists, Florida State University, Tallahassee, FL, June 1983.

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Ingersoll CG, La Point TW, Bergman HL. An early life stage brook trout (*Salvelinus fontinalis*) bioassay testing the independent and combined effects of pH, calcium and aluminum in low conductivity water. Presented at the American Fisheries Society 1984 annual meeting, Cornell University, Ithaca, NY, August 13-16, 1984.

Meyer JS, Ingersoll CG, McDonald LL. Sensitivity analysis of population growth rates estimated from cladoceran chronic toxicity tests. Presented at the 5th annual meeting of SETAC, Arlington, VA, November 4-7, 1984.

Ingersoll CG, La Point TW, Bergman HL. The effects of pH, aluminum and calcium on brook trout (*Salvelinus fontinalis*) hatching, growth and survival. Presented at the 5th annual meeting of SETAC, Arlington, VA, November 4-7, 1984.

Marcus MD, Bergman HL, Ingersoll CG, Mattice JS. A brief summary of surface-water acidification effects on fish. Presented at the Acid Deposition Symposium, The Air Pollution Control Association, Rocky Mountain States Section, Boulder, CO, January 31, 1985.

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Coyle JJ, Ingersoll CG, Buckler DR, May TW. Effects of dietary and waterborne selenium on the reproductive success of bluegill sunfish (*Lepomis macrochirus*). Presented at the 9th annual meeting of SETAC, Arlington, VA, November 13-17, 1988.

Cleveland L, Ingersoll CG, Buckler DR. Effects of simulated episodic pH depressions and aluminum on whole body ions of brook trout. Presented at the 9th annual meeting of SETAC, Arlington, VA. November 13-17, 1988.

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Nelson MK, Ingersoll CG. Chronic sediment toxicity testing with *Hyalella azteca* (Amphipoda) and *Chironomus riparius* (Diptera). Presented at the 13th Symposium on Aquatic Toxicology and Risk Assessment, American Society of Testing and Materials, Atlanta, GA, April 16-18, 1989.

Burch SA, Ingersoll CG, Dwyer FJ, Nelson MK, Buckler DR. The toxicity of effluent and reconstituted drain waters from Stillwater National Wildlife Refuge, Nevada, to fish and aquatic invertebrates. Presented at the 4th annual meeting of the Ozark-Prairie Chapter of SETAC, Columbia, MO, April 29, 1989.

Ingersoll CG. Sediment toxicity test methods. Presented at the USEPA Sediment Steering Committee Meeting, Newport, OR, September, 1989.

Ingersoll CG, Dwyer FJ, Burch SA, Nelson MK, Buckler DR. Use of Fresh- and saltwater organisms for the separation of toxic effects of inorganic contaminants from the toxic effects of salinity. Presented at the 10th annual meeting of SETAC, Toronto, ONT, October 28-November 2, 1989.

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Coyle JJ, Buckler DR, Ingersoll CG, Fairchild JF, May TW. Effects of dietary and waterborne selenium on the reproductive success of bluegill sunfish (*Lepomis macrochirus*). Presented at the 51st Midwest Fish and Wildlife Conference, Springfield, IL, December 3-6, 1989.

Ingersoll CG. Standardization of sediment toxicity testing methods. Presented at the USEPA Sediment Oversight Technical Committee, Vicksburg, MS, March 20-22, 1990.

Burch SA, Dwyer FJ, Ingersoll CG, Finger SE. Toxicity of waters associated with agricultural irrigation at Stillwater National Wildlife Refuge, Fallon, NV. Presented at Selenium V, San Francisco, CA, March 30-31, 1990.

Coyle JJ, Ingersoll CG. Factors influencing the composition and toxicity of sediment elutriate and pore-water preparations. Presented at the Midwest Pollution Control Biologist Meeting, Chicago, IL, April 10-13, 1990.

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Ross PE, Ankley GT, Burton GA, Crecelius E, Filkins JF, Giesy JP, Ingersoll CG, Landrum PF, Mac MJ, Murphy TJ, Rathbun J, Smith VE, Tatem H, Taylor RW. Assessment and remediation of contaminated sediments: Background and approach. Presented at the International Association for Great Lakes Research, Windsor, ONT, May 13-17, 1990.

Ingersoll CG, Buckler DR, Cleveland L, Coyle JJ, La Point TW, Mehrle PM Nelson MK. Assessment and remediation of contaminated sediment (ARCS). III: Development of sediment apparent effects threshold concentrations for selected Great Lakes areas of concern. Presented at the International Association for Great Lakes Research, Windsor, ONT, May 13-17, 1990.

Ingersoll CG. An Overview of sediment toxicity and bioaccumulation testing methods. Presented to the College of Engineering at the University of Wisconsin, Milwaukee, WI, September 11-13, 1990.

Ingersoll CG. Potential incorporation of sediment toxicity tests as a required tier component in pesticide registration. Presented to the USEPA Aquatic Effects Dialogue Committee, Washington, DC, October 19, 1990.

Ingersoll CG. Sediment quality concentrations for selected Great Lakes areas of concern. Presented at the 17th Aquatic Toxicity Workshop, Vancouver, BC, November 4-7, 1990.

Ingersoll CG, Nelson MK, Coyle JJ. Freshwater sediment toxicity testing procedures. A short-course presented at the 11th annual meeting of SETAC, Arlington, VA, November 11-15, 1990.

Cleveland L, Buckler DR, Coyle JJ, Ingersoll CG, La Point TW, Nelson MK. Sediment apparent effects threshold concentrations for selected Great Lakes areas of concern. Presented at the 11th annual meeting of SETAC, Arlington, VA, November 11-15, 1990.

Dwyer FJ, Burch SA, Ingersoll CG, La Point TW, Fairchild JF. Toxicity of linear alkylbenzene sulphonate to fathead minnows and *Hyalella azteca*. Presented at the 11th annual meeting of SETAC, Arlington, VA, November 11-15, 1990.

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Ingersoll CG, Cleveland L, Coyle JJ, King LB, Nelson MK. Acute and chronic effects of contaminated sediments on the amphipod *Hyalella azteca* and the midges *Chironomus riparius* and *Chironomus tentans*. Presented at the annual meeting of ASTM, Atlantic City, NJ, April 14-16, 1991.

Ingersoll CG. Activities of the ASTM subcommittee E47.03 on sediment toxicology and freshwater chronic sediment toxicity tests. USEPA Contaminated Sediment Assessment Workshop, Narragansett, RI, May 6, 1991.

Ingersoll CG, Burton GA, Cleveland L, Coyle JJ, Nelson MK. The acute and chronic effects of contaminated sediment on the amphipod *Hyalella azteca* and the midges *Chironomus riparius* and *Chironomus tentans*. Presented at the annual meeting of the International Association For Great Lakes Research, Buffalo, NY, June 2-6, 1991.

Lanchaster E, Vargo K, Tracy M, Tracy J, Rathbun J, Ingersoll CG, Burton GA, Henry M, Landrum PK. Predicting sediment toxicity in the Buffalo River from "indicator analyses". Presented at the annual meeting of the International Association For Great Lakes Research, Buffalo, NY, June 2-6, 1991.

Burton GA, Ingersoll CG, Ross P, Burnett L, Henry M, Klaine S, Landrum P, Swift M, Tuchman M. Sediment toxicity assessments: Optimal design considerations. Presented at the annual meeting of the International Association For Great Lakes Research, Buffalo, NY, June 2-6, 1991.

Ingersoll CG. Standardization of sediment toxicity testing methods. Presented to the USEPA Tiered Testing Work group, Washington, DC, September 23, 1991.

Cleveland L, Ingersoll CG, Coyle JJ, Nelson MK. Acute and chronic effects of contaminated sediment on the amphipod *Hyalella azteca* and the midges *Chironomus riparius* and *Chironomus tentans*. Presented at the 12th annual meeting of SETAC, Seattle, WA, November 3-7, 1991.

Burton GA, Burnett L, Henry M, Hinman M, Ingersoll C, Klaine S, Landrum P, Nelson M, Ross P, Swift M, Tuchman M. Selecting appropriate test designs for sediment toxicity assessments. Presented at the 12th annual meeting of SETAC, Seattle, WA, November 3-7, 1991.

Swift MC, Canfield TJ, La Point TW, Burton GA, Ingersoll CG. Artificial substrates vs. grab samples: Which is better in sediment toxicity assessments? Presented at the 12th annual meeting of SETAC, Seattle, WA, November 3-7, 1991.

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Nelson MK, Brunson EL, Ingersoll CG, Ellersieck MR. *Hyalella azteca* growth and development in laboratory culture and contaminated sediment. Presented at the 12th annual meeting of SETAC, Seattle, WA, November 3-7, 1991.

Ingersoll CG. Short course on development of sediment criteria. Presented at the 12th annual meeting of SETAC, Seattle, WA, November 3-7, 1991.

Ingersoll CG. Evaluating bioassay performance at Superfund sites. Panel discussion during the 12th annual meeting of SETAC, Seattle, WA, November 3-7, 1991.

Ingersoll CG. Biological assessment of contaminated sediments. Presented to the personnel at the US Fish and Wildlife Bay Estuary Program, Olympia, WA, November 8, 1991.

Ingersoll CG. Use of the apparent effects threshold (AET) approach for assessing aquatic effects of contaminated sediment. Presented to the College of Engineering at the University of Wisconsin, Madison, WI, November 19, 1991.

Ingersoll CG. Whole sediment toxicity testing. Presented at the 4th annual USEPA Superfund environmental evaluation workshop, San Antonio, TX, February 25-27, 1992.

Ingersoll CG. Assessment of contaminated sediment. Presented to the Biology Department at Southwest Missouri State University, Springfield, MO, March 13, 1992.

Ingersoll CG, Cleveland L, Coyle JJ, Dwyer FJ. A comparison of methods used to assess contaminated sediment. Presented at the North American Benthological Society, Louisville, KY, May 25-29, 1992.

Ingersoll CG. Summary of ASTM Activities on freshwater and marine sediment test methods. Presented at the USEPA Tiered Testing Workshop for Freshwater and Marine sediments, USEPA Office of Water and Office of R&D, Washington, DC, September 16, 1992.

Ingersoll CG. Overview of fisheries work group studies for the Milltown Endangerment Assessment Project. Fisheries work group meeting, Denver, CO, September 29, 1992.

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Ingersoll CG. Great Lakes sediment toxicity studies. Presented to Drury College students, Columbia, MO, October 3, 1992.

Brumbaugh WG, Wiedmeyer RH, Ingersoll CG, Mount DR, Stubblefield WA. Milltown Reservoir-Clark Fork River, Montana: Chemical characterization of metals in sediments and pore Waters. Presented at the 13th annual meeting of SETAC, Cincinnati, OH, November 8-12, 1992.

Canfield TJ, Fairchild FJ, Ingersoll CG, La Point TW. Milltown Reservoir-Clark Fork River, Montana: Assessing benthic invertebrate abundance and community structure in areas exposed to metals contaminated runoff. Presented at the 13th annual meeting of SETAC, Cincinnati, OH, November 8-12, 1992.

Kemble NE, Ingersoll CG, Brunson EL, Dwyer FJ, Monda DP, Woodward DF. Milltown Reservoir-Clark Fork River, Montana: Assessing sediment toxicity to invertebrates and fish. Presented at the 13th annual meeting of SETAC, Cincinnati, OH, November 8-12, 1992.

Besser JM, Brumbaugh WG, Kemble NE, Ingersoll CG. Milltown Reservoir-Clark Fork River, Montana: Factors affecting metal bioavailability in contaminated sediment. Presented at the 13th annual meeting of SETAC, Cincinnati, OH, November 8-12, 1992.

Sappington LC, Buckler DR, Dwyer FJ, Ingersoll CG, Jones JR, Ellersieck MR, Mayer FL. Use of the surrogate species concept in assessing contaminant risk to endangered and threatened fishes. Presented at the 13th annual meeting of SETAC, Cincinnati, OH, November 8-12, 1992.

Ingersoll CG. Overview of results of studies to develop standard sediment methods. Presented to the USEPA, Duluth, MN, January 3-4, 1993.

Ingersoll CG. Approaches for assessing contaminated sediment. Presented to Eastman Kodak, Rochester, NY, January 13, 1993.

Ingersoll CG. Data interpretation: Sediment quality guidelines. Presented to the College of Engineering at the University of Wisconsin, Madison, WI, April 14, 1993.

Dwyer FJ, Ingersoll CG. Critical issues in sediment toxicology: Chronic sediment toxicity testing. Presented at the annual meeting of ASTM, Atlanta, GA, April 25-28, 1993.

Ingersoll CG. Statistical analysis of sediment toxicity tests. Presented at USEPA Headquarters, Washington, DC, June 3, 1993.

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Nelson MK, Cleveland L, Coyle JJ, King LB, Kemble NE, Crecelius EA, Ingersoll CG. Reliability of current sediment threshold concentrations and relative species sensitivity based on results of whole sediment exposures. Presented at the International Association for Great Lakes Research, Green Bay, WI, June, 6-10, 1993.

Burton GA, Ingersoll C, and Tuchman M. Evaluating the strengths and weakness of sediment toxicity tests for initial assessments of contamination. Presented at the International Association for Great Lakes Research, Green Bay, WI, June, 6-10, 1993.

Fox, RG, Crecelius E, Ingersoll C, Burton GA. Integrated sediment assessment of Saginaw Bay, Michigan for the ARCS program. Presented at the International Association on Water Pollution Research and Control, Milwaukee, WI, June 14-16, 1993.

Ingersoll CG. Overview of freshwater sediment assessment methods. Presented to the US Army Corps of Engineers, Denver, CO, June 18, 1993.

Ingersoll CG. Assessment of contaminated sediments. Short course presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Ingersoll CG, Ankley GT, Benoit DA, Burton GA, Dwyer FJ, Greer IE, Norberg-King TJ, Winger PV. Standardization of national USEPA methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Norberg-King, TJ, Ankley GT, Ingersoll CG, Burton GA, Hoke R, Kubiz NJ, Landrum PF. Choosing species and methods for standardized tests with freshwater sediments. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Burton GA, Ankley GT, Ingersoll CG, Norberg-King TJ, Winger PV. Evaluation of sediment toxicity test methods: Round robin testing design. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Burton GA, Jacher K, Rowland C, Ankley GT, Benoit D, Norberg-King TJ, Call D, Dawson T, Day K, Dwyer J, Ingersoll CG, England D, Kennedy P, Kubitz J, Giesy J, Smith M, Lazorchak J, Suedel B, Stinson M, Winger P. Round robin testing of the proposed USEPA toxicity test methods. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Dwyer FJ, Ingersoll CG, Kemble NE. Use of standardized formulated sediment in toxicity tests. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

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Brunson EL, Ankley GT, Burton GA, Dwyer FJ, Ingersoll CG, Landrum PF, Lee H, Phipps GL. Bioaccumulation kinetics and field-validation of whole-sediment exposures with the oligochaete, *Lumbriculus variegatus*. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Zumwalt DC, Dwyer FJ, Greer IE, Ingersoll CG. Demonstration of a water-renewal system that accurately delivers small volumes of water to exposure chambers. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

McNulty EW, Greer IE, Ingersoll CG, Rabeni CF. The utility of reference toxicity tests with *Hyalella azteca*. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Kemble NE, Canfield TJ, Ingersoll CG. Cost analysis comparisons of laboratory toxicity tests, benthic invertebrate community analyses, and chemical analyses for making integrated ecological risk assessments. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Dwyer FJ, Canfield TJ, Haverland PS, Ingersoll CG, Kemble NE. The use of the sediment quality triad approach for two freshwater systems. Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Greer IE, McNulty EW, Ingersoll CG. A method for the collection of known-age *Hyalella azteca.* Presented at the 14th annual meeting of SETAC, Houston, TX, November 14-18, 1993.

Ingersoll CG, Ankley GT, Benoit DA, Burton GA, Dwyer FJ, Greer IE, Norberg-King TJ, Winger PV. Standardization of national USEPA methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. Presented at the 6th International Symposium on the Interactions Between Sediment and Water, Santa Barbara, CA, December 5-8, 1993.

Burton GA, Ingersoll CG, Tuchman M. Selection of an optimal test battery for determining freshwater sediment toxicity. Presented at the 6th International Symposium on the Interactions Between Sediment and Water, Santa Barbara, CA, December 5-8, 1993.

Canfield TJ, Dwyer FJ, Haverland PS, Ingersoll CG, Kemble NE. Use of the sediment quality triad approach to assess contamination of Great Lakes sediments. Presented at the 55th annual Midwest Fish and Wildlife Conference, St. Louis, MO, December 11-15, 1993.

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Armitage T, Ingersoll C. USEPA's national contaminated sediment management strategy. Presented at the 4th ASTM Symposium on Environmental Toxicology and Risk Assessment, Montreal Quebec, April 11-13, 1994.

Dwyer FJ, Ankley GT, Benoit DA, Brunson EL, Burton GA, Greer IE, Hoke RA, Ingersoll CG, Norberg-King TJ, Winger PV. USEPA's methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. Presented at the 4th ASTM Symposium on Environmental Toxicology and Risk Assessment, Montreal Quebec, April 11-13, 1994.

Schlekat C, Ingersoll CG. Measuring the toxicity and bioaccumulation of sediment-associated contaminants with estuarine and marine invertebrates: Methods employed by federal programs within the United States. Presented at the 4th ASTM Symposium on Environmental Toxicology and Risk Assessment, Montreal Quebec, April 11-13, 1994.

Ingersoll CG, Brunson EL, Canfield TJ, Dwyer FJ, Haverland PS, Henke CE, Kemble NE, Mount DR. Calculation of sediment effect concentrations (SECs) for *Hyalella azteca* and *Chironomus riparius*. Presented at the 4th ASTM Symposium on Environmental Toxicology and Risk Assessment, April 11-13, 1994, Montreal Quebec.

Besser JM, Kubitz JA, Giesy JP, Ingersoll CG. Relationship of metal bioaccumulation to toxicity in freshwater invertebrates. Presented at the North American Benthological Society meeting, Orlando, FL, May 23-27, 1994.

Kemble NE, Ingersoll CG, Brumbaugh WG, Dwyer FJ, Canfield TJ. Assessing sediment toxicity to invertebrates and fish. Presented at the North American Benthological Society meeting, Orlando, FL, May 23-27, 1994.

Canfield, TJ, Fairchild JF, Ingersoll CG, Kemble NE. Assessing benthic invertebrate abundance and structure exposed to metals contaminated sediment. Presented at the North American Benthological Society meeting, Orlando, FL, May 23-27, 1994.

Ingersoll CG. Short course on USEPA freshwater sediment toxicity and bioaccumulation methods. Presented at the 15th annual meeting of SETAC, Denver, CO, October 30, 1994.

Ingersoll CG, Brunson EL, Canfield TJ, Dwyer FJ, Haverland PS, Henke CE, Kemble NE, Mount DR. Evaluation of sediment effect concentrations (SECs) for *Hyalella azteca* and *Chironomus riparius*. Presented at the 15th annual meeting of SETAC, Denver, CO, October 30-November 3, 1994.

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Haverland PS, Brunson NE, Canfield TJ, Dwyer FJ, Henke CE, Ingersoll CG, Kemble KE, Mount DR. Calculation of sediment effect concentrations (SECs) for *Hyalella azteca* and *Chironomus riparius*. Presented at the 15th annual meeting of SETAC, Denver, CO, October 30-November 3, 1994.

Canfield TJ, Kemble NE, Ingersoll CG. Assessing chironomid deformities in field- and laboratory-exposed organisms from organic- and metal-contaminated sediments. Presented at the 15th annual meeting of SETAC, Denver, CO, October 30-November 3, 1994.

Besser JM, Ingersoll CG, Giesy JP. Metal bioavailability in freshwater sediments: Influence of acid-volatile sulfide and organic matter. Presented at the 15th annual meeting of SETAC, Denver, CO, October 30-November 3, 1994.

Kemble NE, Dwyer FJ, Ingersoll CG. Development of a formulated control sediment for use in whole-sediment toxicity testing. Presented at the 15th annual meeting of SETAC, Denver, CO, October 30-November 3, 1994.

Canfield TJ, Dwyer FJ, Ingersoll CG, Mount DR. Using an integrated field and laboratory approach for assessing contaminated sediments. Presented at the North American Benthological Society meeting, Keystone, CO, May 30-June 3, 1995.

Haverland PS, Dwyer FJ, Henke CE, Ingersoll CG, Mount DR, Field J, MacDonald DD, Smith SL. Predictions of sediment toxicity using a database for *Hyalella azteca* and *Chironomus riparius*. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Ingersoll CG, Dwyer FJ, Ankley GT, Benoit DA, Norberg-King TJ, Swartz RC, Scott JK, Day KE, Scroggins R, McLeay DJ. Harmonization of standard methods used to conduct toxicity tests with sediment in North America. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Mount DR, Henke CE, Ingersoll CG, Besser JM, Ankley GT, Norberg-King TJ, West CW. Development of toxicity identification procedures for whole-sediment toxicity tests. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Kemble NE, Dwyer NE, Hardesty DK, Ingersoll CG. Formulated sediment for use in whole-sediment toxicity testing. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Brunson EL, Dwyer FJ, Ingersoll CG. Evaluation of reproduction as an endpoint in chronic toxicity tests with the amphipod *Hyalella azteca*. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

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Kemble NE, Brunson EL, Canfield TJ, Dwyer FJ, Ingersoll CG. Laboratory toxicity test with *Hyalella azteca* exposed to whole sediments from the Upper Mississippi River. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Brunson EL, Canfield TJ, Dwyer FJ, Ingersoll CG, Kemble NE. Sediment bioaccumulation test with upper Mississippi River sediments using the oligochaete *Lumbriculus variegatus*. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Canfield TJ, Brunson EL, Dwyer FJ, Ingersoll CG, Kemble NE. Assessing upper Mississippi river sediments using benthic invertebrates and the sediment quality triad. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Henke CE, Dwyer FJ, Ingersoll CG, Mount DR, Mayer FL. Evaluation and use of standard effluent toxicity tests for protection of endangered and threatened species. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Canfield TJ, Kemble NE, Ingersoll CG. Use of chironomid deformities in field and laboratory assessments of contaminated sediments. Presented at the 2nd SETAC World Congress, Vancouver, BC, November 5-9, 1995.

Ingersoll CG, Brunson EL, Dwyer FJ, Hardesty D, Kemble NE, Benoit DA, Sibley PK. Reproduction as an endpoint in sediment toxicity tests with the amphipod *Hyalella azteca* and the midge *Chironomus tentans*. Presented at the 6th ASTM symposium on Environmental Toxicology and Risk Assessment, Orlando, FL, April 15, 1996.

Ingersoll CG, Johns M, Kemble NE, Reish D, Ross P. ASTM standards for measuring the toxicity and bioaccumulation of sediment-associated contaminants with invertebrates. Short course presented at the 6th ASTM symposium on Environmental Toxicology and Risk Assessment, Orlando, FL, April 17, 1996.

Haverland PS, Canfield TJ, Dwyer FJ, Ehrhardt EA, Ingersoll CG, Kemble NE, Field LJ, Long ER, MacDonald DD, Smith SL. Use of sediment quality guidelines to interpret toxicity data for freshwater sediments. Presented at the 17th annual meeting of SETAC, Washington, DC, November 17-21, 1996.

Kemble NE, Dwyer FJ, Ingersoll CG. Evaluation of feeding levels on survival and reproduction of *Hyalella azteca* in a formulated sediment. Presented at the 17th annual meeting of SETAC, Washington, DC, November 17-21, 1996.

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Besser J, Ingersoll C, Mount D. TIE methods for freshwater sediments: Effect of zeolite on porewater ammonia concentrations and toxicity. Presented at the 17th annual meeting of SETAC, Washington, DC, November 17-21, 1996.

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Ingersoll CG. Use of numerical sediment quality guidelines for the USEPA National Sediment Quality Survey Report. USEPA meeting January 23, 1997, Arlington, VA.

Ingersoll CG, Besser JM, Dwyer FW. Development and application of methods for assessing the bioavailability of contaminants associated with sediments: I. Toxicity and the sediment quality triad. U.S. Geological Survey Workshop on Expanding USGS Sediment Research Capabilities in Today's USGS February 4-7, 1997 in Reston, VA and Harper's Ferry, WV.

Chris Ingersoll, John Besser, and Jim Dwyer, Midwest Science Center (MSC), Biological Resources Division, U.S. Geological Survey, Columbia, Missouri.

Ingersoll CG, Canfield TJ, Dwyer FJ, Ehrhardt EA, Haverland PS, Kemble NE, MacDonald DD, Field LJ, Long ER. Predictions of sediment toxicity using sediment quality guidelines (SQGs). Presented at the 7th ASTM Symposium on Environmental Toxicology and Risk Assessment, St. Louis, MO. April 7-10, 1997.

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DeWitt TH, Ingersoll CG, Berry WJ, Chapman GA, Lamberson JO. Foundations of ecologically-based toxicity tests for marine environments. Presented at the 18th annual meeting of SETAC, San Francisco, CA, November 16-20, 1997.

Johnson BT, Kemble NE, Ingersoll CG. Natural whole sediment assessments with the Microtox acute toxicity test system. Presented at the 18th annual meeting of SETAC, San Francisco, CA, November 16-20, 1997.

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Norberg-King TJ, Mount DR, Sibley PK, Benoit DA, Burton GA, Rowland C, Ingersoll CG, Dwyer FJ, Kemble NE, Hall T. Development of life-cycle methods for freshwater sediments: Inter-laboratory evaluation of sediment tests. Presented at the 18th annual meeting of SETAC, San Francisco, CA, November 16-20, 1997.

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Canfield TJ, Ingersoll CG, Kemble NE. Using chironomid deformities as developmental indicators of sediment contamination in field- and laboratory-exposed organisms. Presented at the 8th ASTM symposium on Environmental Toxicology and Risk Assessment, Atlanta, GA, April 20-23, 1998.

Ingersoll CG. Short course for the North Atlantic Chapter of SETAC dealing with "Using a weight of evidence approach to sediment assessment," Boston University, Boston, MA, June 16, 1998.

Ingersoll CG. Sediment toxicity testing. A presentation at a short course for the U.S. EPA Great Lakes National Research Program Office on "Collection analysis, and interpretation of sediment quality data", Chicago, IL, November 3-4, 1998.

Canfield TJ, Ingersoll CG. A case study on assessing sediment quality in the Great Lakes using the sediment quality triad. A presentation at a short course for the U.S. EPA Great Lakes National Research Program Office on "Collection analysis, and interpretation of sediment quality data", Chicago, IL, November 3-4, 1998.

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Berry WJ, Field LJ, Long ER, Hansen DJ, Ingersoll CG, Keating FJ, MacDonald DD, Mount DR. The best of both worlds: Improving sediment assessment by combining the use of empirically-derived and equilibrium partitioning approaches. Presented at the 19th annual meeting of SETAC, Charlotte, NC, November 15-19, 1998.

Kemble NE, Dwyer FJ, Ingersoll CG, Schuerenberg HD. Relative sensitivity of endpoints measured in long-term water-only exposures with the amphipod *Hyalella azteca* and the midge *Chironomus tentans*. Presented at the 19th annual meeting of SETAC, Charlotte, NC, November 15-19, 1998.

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Dwyer, FJ, Hardesty DK, Henke CE, Ingersoll CG, Sappington LC, Whites DE. Assessing contaminant sensitivity of endangered and threatened aquatic species. Presented at the 19th annual meeting of SETAC, Charlotte, NC, November 15-19, 1998.

Besser JM, Brumbaugh WG, Ingersoll CG, May TW. An evaluation of the role of organic matter in controlling bioavailability and toxicity of cadmium and copper in sediments. Presented at the 19th annual meeting of SETAC, Charlotte, NC, November 15-19, 1998.

Klump JV, Ingersoll CG, Power M, Reid LM, Fairbrother A, Harris HJ, Adams WJ, Cardwell R. Identifying multiple stressors in ecological risk assessment. Presented at the 19th annual meeting of SETAC, Charlotte, NC, November 15-19, 1998.

Ingersoll CG, MacDonald D. Sediment toxicity testing methods and data interpretation. Presented at the USFWS National Environmental Contaminants meeting, Ridgedale, MO, April 12, 1999.

Kemble NE, Dwyer FJ, Ingersoll CG, Williams HD. Relative sensitivity of endpoints measured in long-term water-only exposures with the amphipod *Hyalella azteca*. Presented at the 9th ASTM symposium on Environmental Toxicology and Risk Assessment, Seattle, WA, April 19-21, 1999.

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Wang N, Besser JM, Dwyer FJ, Ingersoll CG. Effects of copper on survival, growth, and variation in size of fathead minnows. Presented at the Ozark-Prairie SETAC meeting in Carbondale, IL, May 20-22, 1999.

Ankley GT, Cameron K, Campbell P, Crane M, DeFur P, Huet MC, Ingersoll C, LeBlanc G, Matthiessen P, Stahl R, Tattersfield L, Vethaak D. The international SETAC workshop on endocrine disruption in invertebrates: Endocrinology, testing and assessment (EDIETA). Presented at the 9th annual meeting of SETAC-Europe, Leipzig, Germany, May 25-29, 1999.

Ingersoll CG, MacDonald DD. Approaches and tools for assessing contaminated sediments. Presented to the US Department of the Interior, Office of Environmental Policy and Compliance, Washington, DC, June 14, 1999.

Ingersoll CG. Sediment toxicity testing methods. Presented at a USEPA workshop on approaches for assessing and remediating contaminated sediments. Athens, GA, September 21-22, 1999.

Ingersoll CG, MacDonald DD, Kemble NE, Wang N, Field LJ, Severn CG. Derivation and assessment of consensus-based freshwater sediment quality guidelines. Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Kemble NE, Ingersoll CG, Willman HD, Dwyer FJ. Relative sensitivity of endpoints measured in water or sediment exposures with the amphipod *Hyalella azteca* or the midge *Chironomus tentans*. Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Field LJ, MacDonald DD, Norton SB, Severn CG, Ingersoll CG. Beyond thresholds: Using logistic regression models to estimate the probability of sediment toxicity. Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Severn CG, Field LJ, MacDonald DD, Norton SB, Long ER, Ingersoll CG. Creating databases for sediment quality guideline development and evaluation. Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Wang N, Besser JM, Dwyer FJ, Ingersoll CG. Chronic and acute toxicity of copper to endangered and surrogate species of fish. Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

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Norberg-King TJ, Mount DR, Burton GA, Rowland C, Ingersoll CG, Kemble NE, Dwyer FY, Sibley P, Hall TJ. Definitive Results of the Inter-laboratory Evaluation of 10-d and Life-Cycle Sediment Tests with the midge *Chironomus tentans* and the amphipod *Hyalella azteca.*

Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Brix KV, Dwyer FJ, Adams WJ, Ingersoll CG, DeForest, DK, Sappington LC, Mayer FL. Evaluation of the relative sensitivity of threatened and endangered species to contaminants. Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Ankley GT, Cameron K, Campbell P, Crane M, DeFur P, Huet MC, Ingersoll C, LeBlanc G, Matthiessen P, Stahl R, Tattersfield L, Vethaak D. The international SETAC workshop on endocrine disruption in invertebrates: Endocrinology, testing and assessment (EDIETA). Presented at the 20th annual meeting of SETAC, Philadelphia, PA, November 14-18, 1999.

Ingersoll CG, Hinman M. Harmonization of environmental standards for assessing biological effects and fate by ASTM Committee E47and Committee D02. Presented at the 10th Symposium on Environmental Toxicology and Risk Assessment, Toronto, Ontario, April 10-12, 2000.

Ingersoll CG, MacDonald DD, Berger T. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Presented at the 10th Symposium on Environmental Toxicology and Risk Assessment, Toronto, Ontario, April 10-12, 2000.

MacDonald DD, Crane J, Severn C, Ingersoll CG, Berger T, Linskoog R, Smorong D. Development and evaluation of numerical sediment quality objectives for the St. Louis River Area of Concern. International Association for Great Lakes Research. Presented at the 43rd Annual International Conference on Great Lakes Research, Cornwall, Ontario, May 21-26, 2000.

Ingersoll CG, Wang N, Besser JM, Haverland PS, Kemble NE, MacDonald DD, Lindskoog R, Smorong D, Field LJ, Crane J, Severn C. Prediction of sediment toxicity using consensus-based freshwater sediment quality guidelines (SQGs). Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Field LJ, Norton SB, MacDonald DD, Severn CG, Ingersoll CG. Estimating the probability of toxicity from sediment chemistry. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

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Crane JL, MacDonald DD, Lindskoog R, Smorong D, Severn C, Ingersoll CG, Field J, Berger T. Development and evaluation of numerical sediment quality objectives for the St. Louis River Area of Concern. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Smorong D, Lindskoog R, MacDonald DD, Ingersoll CG, Sparks D, Smith J. Application of GIS-based tools in sediment quality assessment. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

MacDonald DD, Smorong D, Lindskoog R, Ingersoll CG, Haverland PM, Wang N, Sparks D, Smith J. Application of a GIS-based approach for assessing sediment quality conditions. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Besser JM, Ingersoll CG, Wang N, May TW. Site-specific thresholds for the toxicity of copper and zinc to brook trout in the upper Animas River, Colorado. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Kemble NE, Ingersoll CG, Kunz JL. Relative sensitivity of endpoints measured in long-term water or sediment exposures with the amphipod *Hyalella azteca* and the midge *Chironomus tentans*. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

DeForest DK, Brix KV, Dwyer FJ, Mayer FL, Buckler DR, Ingersoll CG, Sappington L, Adams W.J. Chemical risks to threatened and endangered fish species at concentrations below water quality criteria: Is it feasible to ensure protection of individuals? Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Hayward JMR, Jones JR, Whites DW, Ingersoll CG, Mount DR, Ireland DS. Storage effects on the toxicity of DDE-spiked sediment. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Hayward JMR, Jones JR, Whites DW, Ingersoll CG, Mount DR, Ireland DS. Role of sediment type when using colonization trays to assess macroinvertebrate assemblages. Presented at the 21st annual meeting of SETAC, Nashville, TN, November 12-16, 2000.

Ingersoll CG, Finger S, MacDonald DD. Natural Resource Damage Assessment and Restoration (NRDAR): An assessment of sediment injury in the Indiana Harbor Area of Concern. Presented to the USGS Central Region Leadership Team, Columbia, MO, March 13, 2001.

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Hayward JMR, Jones JR, Whites DW, Ingersoll CG, Mount DR, Ireland DS. Field validation of long-term laboratory sediment toxicity tests with *Hyalella azteca* and *Chironomus tentans*. Presented at the 11st annual meeting of SETAC Europe, Madrid Spain, May 6-11, 2001.

Whites DW, Ingersoll CG, Hayward JMR, Jones JR, Mount DR, Ireland DS. Field validation studies of laboratory sediment toxicity tests using a field-collected sediment from Indiana Harbor. Presented at the North American Benthological Society, LaCrosse, WI, June 3-8, 2001.

Hayward JMR, Jones JR, Whites DW, Ingersoll CG, Mount DR, Ireland DS. *In-situ* colonization trays vs. standard laboratory sediment toxicity tests: A field validation study using a DDD-spiked sediment. Presented at the North American Benthological Society, LaCrosse, WI, June 3-8, 2001.

Ingersoll CG, Orthey S, Scroggins RP, Huet M-C, Reish D. Comparison of processes used to develop standardized methods in environmental toxicology and chemistry. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Staveley JP, Ingersoll CG. Comparison of standard methods for conducting sediment and aquatic and terrestrial plant toxicity tests. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

MacDonald DD, Ingersoll CG. Guidance manual to support the assessment of contaminated sediments in the Great Lakes Basin. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Ireland DS, Keating FJ, Mount DR, Berry WJ, Ingersoll CG, Field LJ. The incidence and severity of sediment contamination in surface waters of the United States - National Sediment Quality Survey. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Carr RS, Nipper M, Ingersoll CG, Shortelle A, Johnson TJ, Gaston GR, Biedenbach J, Kemble N, Hooten R, MacDonald DD. Comparison of porewater and solid-phase toxicity tests performed in support of the Calcasieu estuary remedial investigation, Louisiana. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Kemble NE, Hardesty DK, Ingersoll CG, MacDonald DD. Evaluation of the toxicity of sediment samples from Calcasieu estuary: Comparing 10- and 28-day sediment exposures with the amphipod *Hyalella azteca*. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

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Kemble NE, Ingersoll CG, Kunz JL, Canfield TJ. Evaluation of sediment toxicity at constructed wetlands using whole-sediment exposures with the amphipod *Hyalella azteca*. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Kunz JL, Kemble NE, Ingersoll CG, Wang N. Relative sensitivity of endpoints measured in long-term exposures with the amphipod *Hyalella azteca* and the midge *Chironomus tentans*. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Hayward JMR, Jones JR, Whites DW, Ingersoll CG, Mount DR, Ireland DS. Field-validation studies of long-term toxicity tests for freshwater sediments. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Wang N, Besser JM, Buckler DR, Dwyer FJ, Ingersoll CG, Mayer FL. Acute and chronic toxicity of pentachlorophenol to endangered and surrogate fish species. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Brunson, EJ, Besser JM, Brumbaugh WG, Ingersoll CG. Development of an equilibrated aqueous+dietary exposure system for evaluate the acute and chronic of lead to *Hyalella azteca*. Presented at the 22nd meeting of SETAC, Baltimore, MD, November 11-15, 2001.

Ingersoll CG. Overview of toxicity assessment tools for contaminated sediments. Presented to the Missouri Department of Natural Resources, Jefferson City, MO, April 24, 2002.

Ingersoll CG, MacDonald DD. A guidance manual to support the assessment of contaminated sediments in freshwater ecosystems. Presented at a USEPA meeting on issues in assessing and managing ecological risks at contaminated sediment sites, Chicago, IL, June 4, 2002.

Ingersoll CG. Development of ASTM standards for assessing the fate and effects of contaminants in the environment. Presented at the 51st annual conference of the Standards Engineering Society, Pittsburgh, PA, August 13, 2002.

Dwyer FJ, Hardesty DK, Henke CE, Ingersoll CG, Whites DW, Mayer FL, Augspurger T. Assessing the sensitivity of endangered and threatened fish species using WET.

Besser JM, Leib KJ, Wirt L, Wright WG, Ingersoll CG. Seasonal variation in toxicity of high-altitude streams affected by hard-rock mining: the upper Animas River watershed, Colorado. Presented at an Abandoned Minelands workshop in Denver, October 22-24, 2002.

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Wenning RJ, Adams WJ, Batley GE, Berry WJ, Burton GA, Douglas WS, Engler RM, Ingersoll CG, Moore DW, Stahl RG. Use of sediment quality guidelines (SQGs) and related tools for the assessment of contaminated sediments: Overview of a SETAC Pellston Workshop. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Word JQ, Anghera M, Albrecht B, Baudo R, Bay SM, Di Toro DM, Hyland JL, Ingersoll CG, Landrum PF, Long ER, Meador J, Moore DW, O'Connor TP, J.Shine J. The use of SQGs to estimate the potential for effects, or no effects, of sediment-associated contaminants in laboratory toxicity tests and in benthic community assessments. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Kunz JL, Kemble NE Ingersoll CG. Evaluation of sediment toxicity at constructed wetlands using whole-sediment exposures with the amphipod *Hyalella azteca*. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Ingersoll CG, Wang N, MacDonald DD, Smorong DE, Lindskoog RA. Predictive ability of freshwater sediment quality guidelines on a regional basis. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Wang N, Besser J, Buckler DR, Johnson BT, Ingersoll CG, Kurtzweil ML, Honegger JL, McKee MJ. Influence of sediment on the fate and toxicity of the surfactant MON 0818 to *Daphnia magna*. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Shortelle AB, MacDonald DD, Ingersoll CG, Carr RS, Meyer J. Acute toxicity of sediments to *Ampelisca abdita* compared to sediment and porewater chemistry. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Ivey CD, Kemble NE, Besser JM, Brumbaugh WG, Hardesty DG Ingersoll. CG. Effects of chromium in sediments: 2. Chronic toxicity of chromium to the amphipod, *Hyalella azteca* in water-only exposures. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Besser JM, Brumbaugh WG, Kunz JL, Ingersoll CG. Effects of chromium in sediments: 3. Toxicity of chromium(VI)-spiked freshwater sediments to the amphipod, *Hyalella azteca.* Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

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Brumbaugh WG, May TW, Wiedmeyer RH, Besser JM, Ingersoll CG. Effects of chromium in sediment: 4. Monitoring of chromium in sediment, pore water, and overlying water of Cr(VI)-spiked freshwater sediments. Presented at the 23rd meeting of SETAC, Salt Lake City, UT, November 16-20, 2002.

Wang N, Greer E, Whites D, Ingersoll CG, Roberts A, Dwyer J, Augspurger T, Kane C, Tibbott C. An evaluation of the viability of glochidia after removal from mussels. To be presented at the Freshwater Mollusk Conservation Society Symposium in Durham, NC, March 16-19, 2003.

SESSIONS CHAIRED

Sediment methods standardization. ASTM subcommittee E47.03, spring and fall meeting, 1987-1995.

Methods standardization. ASTM Committee E47, spring and fall meeting, 1996-.

Assessment of contaminated sediment. Platform session at the 11th annual meeting of SETAC, Arlington, VA, November 13, 1990.

Contaminated sediment: Quality assurance. Platform session at the 12th annual meeting of SETAC, Seattle, WA, November 5, 1991.

Milltown Reservoir-Clark Fork River endangerment assessment. Platform session at the 13th annual meeting of SETAC, Cincinnati, OH, November 10, 1992.

Workshop entitled: Managing contaminated sediment: Measurement, interpretation, and remediation, College of Engineering, University of Wisconsin, Madison, WI, April 14, 1993.

Critical issues in sediment toxicology. Platform session at the 3rd ASTM Symposium on Environmental Toxicology and Risk Assessment, Atlanta, GA, April 27, 1993.

Scientific and regulatory issues associated with sediment contamination. Session at the American Chemical Society, San Diego, CA, March 13, 1994.

International approaches to sediment toxicity assessment. Session at the 4th ASTM Symposium on Environmental Toxicology and Risk Assessment, Montreal, Quebec, April 11-13, 1994.

Development and use of formulated sediment in toxicity testing. Session at the 15th annual meeting of SETAC, Denver, CO, October 30-November 3, 1994.

Interpretation issues in sediment assessments. Session at the 17th annual meeting of SETAC, Washington, DC, November 17-21, 1996.

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Bioaccumulation short course presented at the 6th ASTM symposium on Environmental Toxicology and Risk Assessment, Orlando, FL, April 15, 1996.

Sediment quality guideline short course presented at the 18th annual meeting of SETAC, San Francisco, CA, November 16-20, 1997.

Tribute to Rick Swartz and Dave Hanson presented at the 18th annual meeting of SETAC, San Francisco, CA, November 16-20, 1997.

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Appendix 2

Criteria for Evaluating Candidate Data Sets

Appendix 2. Criteria for Evaluating Candidate Data Sets

1.1 Introduction

A project database was developed to support the assessment of injury to human uses of fishery resources in the Grand Calumet River and Indiana Harbor Canal, the Grand Calumet River Lagoons, and Indiana Harbor and the nearshore areas of Lake Michigan. The database is comprised of sediment chemistry and fish tissue residue data from the Assessment Area. These data were used to determine if human uses of fishery resources within the Assessment Area have been injured due to discharges of oil or releases of other hazardous substances. To assure that the data used in the assessment met project data quality objectives, all of the candidate data sets were critically evaluated prior to inclusion in the database. However, the screening process was also designed to be flexible to assure that professional judgement could also be used when necessary in the evaluation process. In this way, it was possible to include as many data sets as possible and, subsequently, use them to the extent that the data quality and quantity dictate. In total, more than 125 data sets were evaluated to obtain the information needed to accomplish these objectives.

1.2 Criteria for Evaluating Whole-Sediment and Tissue Chemistry

The whole sediment and tissue chemistry data from the Assessment Area were used to determine if human uses of fishery resources within the Assessment Area have been injured due to discharges of oil or releases of other hazardous substances. Data from individual studies were considered to be acceptable for use in this assessment if:

- Samples were collected within the study area (see Natural Resources Trustees 1997 for a complete description of the study area);
- Matching information was available on the concentrations of COPCs in sediment samples and on levels of total organic carbon (TOC);

- Tissue chemistry data was reported on a wet weight basis (or information on percent moisture was available to allow the data to be converted to a WW basis);
- Appropriate procedures were used for collecting, handling, and storing sediments (e.g., ASTM 2000d) and other samples;
- The concentrations of chemicals of concern were measured in samples (see Natural Resources Trustees 1997 for a list of hazardous substances);
- Appropriate analytical methods were used to generate chemistry data. The methods that were considered to be appropriate included USEPA approved methods, other standardized methods (e.g., ASTM methods, SW-846 methods), or methods that have been demonstrated to be equivalent or superior to standard methods; and,
- Data quality objectives (DQOs) were met. The criteria that were used to evaluate data quality included;
  - the investigator indicated that DQOs had been met,
  - analytical detection limits were reported and lower than the associated sediment or tissue benchmark (measurements with detection limits above the associated sediment or tissue benchmark were included in the project database, but not used in data analyses); accuracy and precision of the chemistry data were reported and within acceptable ranges for the method; sample contamination was not noted (i.e., analytes were not detected in method blanks),
  - in the absence of complete QA/QC information, chemistry data were considered to be acceptable if they were generated post-1985 for use in a regulatory context (i.e., it was assumed that the USEPA QA/QC guidelines were likely met for such data),
  - the results of a detailed third party review indicated that the data were acceptable, and/or,
  - professional judgement indicated that the data set was likely to be of sufficient quality to be used in the assessment (i.e., in conjunction with author communications and/or other investigations); and,

- Incomplete information was available to conduct a full evaluation or certain data quality objectives were not met, but best professional judgement indicated that the data set was likely to be of sufficient quality to be used in the assessment.

Appendix 3

Whole-Sediment Chemistry Data Tables

Table A3.1 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1980; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**SITE 1**	**SITE 2**	**SITE 3**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC
Reach	USC	USC	USC
Sampling Year	1980	1980	1980
Depth (ft)	0-3.28	0-3.28	0-3.28
Latitude	41.65917	41.65571	41.65115
Longitude	-87.4541	-87.45867	-87.4645
Percent TOC	2.08	2.8	2.26
Percent Moisture	NR	NR	NR
Polychlorinated Biphenyls (µg/kg OC)			
Aroclor 1242	<4810	<3570	<4420
Aroclor 1248	**1490000**	**1010000**	**1120000**
Aroclor 1254	<4810	**257000**	**540000**
Aroclor 1260	<4810	<3570	<4420
Total PCBs[1]	**1490000**	**1260000**	**1650000**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported.
GCR/IHC = Grand Calumet River and Indiana Harbor Canal; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.2 Sediment chemistry data used to assess injury to human uses of fishery resources (Polls 1988; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	E 5.4	E 2.7	E 3.8	E 0.6	E 1.3	A 0.2	A 0.5	A 1.0	A 1.5	A 2.0	A 3.0	B 0.2	B 0.5
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM
Reach	LGB	USC	USC	IH	IH	LM	LM	LM	LM	LM	LM	LM	LM
Sampling Year	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.6465	41.65603	41.64237	41.67643	41.6677	41.684	41.68567	41.69	41.6955	41.70033	41.71	41.68467	41.68983
Longitude	-87.482	-87.45783	-87.47117	-87.44103	-87.44195	-87.45016	-87.454	-87.46283	-87.46833	-87.475	-87.48333	-87.451	-87.45033
Percent TOC	4.7398	6.8859	7.1151	1.0392	2.3718	0.015	0.4295	0.0258	0.2529	0.3919	0.0652	0.0083	0.1674
Percent Moisture	73.6	70.9	76.8	52	59.2	25.1	28.9	23.9	42.7	50.6	28.5	30.2	35
Polychlorinated Biphenyls (µg/kg OC)													
Total PCBs[1]	**365000**	**147000**	**113000**	**140000**	**94000**	**267000**	**11600**	**116000**	**11900**	**23000**	**15300**	**241000**	**35800**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; IH = Indiana Harbor; LM = Lake Michigan; LGB = Lake George Branch; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.2 Sediment chemistry data used to assess injury to human uses of fishery resources (Polls 1988; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	B 1.0	B 2.0	B 3.0	B 5.0	C 0.5	C 1.0	C 1.5	C 3.0	D 0.3	D 2A	D 2B	D 3.0	D 5.0
Geographic Area	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM
Reach	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM	LM
Sampling Year	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.69633	41.7125	41.72633	41.67733	41.68767	41.69233	41.69767	41.71333	41.68583	41.67667	41.67283	41.676	41.67733
Longitude	-87.448	-87.44833	-87.44867	-87.30617	-87.44067	-87.4345	-87.4285	-87.40517	-87.46183	-87.40067	-87.40234	-87.34517	-87.30617
Percent TOC	0.138	0.2546	0.024	0.0216	0.012	0.0159	0.0127	0.0182	0.0298	0.0126	0.0522	0.1667	0.1069
Percent Moisture	48.9	35.7	32.6	26.8	31	42.2	33.3	13	36.5	14.2	40.6	50.5	62
Polychlorinated Biphenyls (μg/kg OC)													
Total PCBs[1]	**65200**	**15700**	**83300**	**278000**	**500000**	**126000**	**394000**	**110000**	**67100**	**79400**	**38300**	**6000**	**74800**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; IH = Indiana Harbor; LM = Lake Michigan; LGB = Lake George Branch; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.3 Sediment chemistry data used to assess injury to human uses of fishery resources (Risatti & Ross 1989; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**1**	**12/12A**	**2**	**3**	**6**	**7**	**9A**	**10**	**11/11A**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM
Reach	LGB	USC	USC	USC	LM	LM	LM	LM	LM
Sampling Year	1988	1988	1988	1988	1988	1988	1988	1988	1988
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.64684	41.64883	41.63963	41.65542	41.68529	41.68936	41.67646	41.68878	41.67649
Longitude	-87.481	-87.4682	-87.4711	-87.4587	-87.4501	-87.4683	-87.4018	-87.4314	-87.401
Percent TOC	12.57	10.3	16.84	12.66	0.07	0.03	2.74	1.43	1.91
Percent Moisture	60.06	39.68	84.51	63.32	24.08	20.31	53.86	16.71	53.15
Polychlorinated Biphenyls (μg/kg OC)									
Total PCBs[1]	**569**	**44.2**	**609**	**460**	**79400**	**59000**	**694**	**4790**	**25900**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; IH = Indiana Harbor; LM = Lake Michigan; LGB = Lake George Branch; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.4 Sediment chemistry data used to assess injury to human uses of fishery resources (USEPA 1996a; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IH 01 05	IH 01 06	IH 01 07	IH 01 08	IH 01 10	IH 01 03	IH 01 04
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	IH/LM	IH/LM
Reach	USC	USC	USC	USC	USC	IH	IH
Sampling Year	1989	1989	1989	1989	1989	1989	1989
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.66085	41.65518	41.64598	41.64676	41.63982	41.67395	41.66798
Longitude	-87.45175	-87.45998	-87.47243	-87.48051	-87.47146	-87.43911	-87.4363
Percent TOC	11.1	11.58	8.77	10.41	12.25	7.65	5.64
Percent Moisture	49.77	70.2	53.33	76.98	80.42	59.24	55.24
Polycyclic Aromatic Hydrocarbons (µg/kg OC)							
Benz[a]anthracene	**52300**	**138000**	**365000**	**288000**	**56300**	**95400**	**74500**
Benzo(a)pyrene	**51400**	**216000**	**353000**	**279000**	**75100**	**131000**	**124000**
Benzo(k)fluoranthene	**45900**	**199000**	**154000**	**202000**	**79200**	**131000**	**74500**
Chrysene	**64900**	**225000**	**582000**	**317000**	**76700**	**112000**	**92200**
Indeno(1,2,3-c,d)pyrene	**59500**	**17300**	**115000**	**183000**	**47300**	**95400**	**94000**
Polychlorinated Biphenyls (µg/kg OC)							
Aroclor 1016	<3240	<4320	<4680	<4710	<5630	<4710	<6380
Aroclor 1242	**96700**	**207000**	**490000**	**173000**	**58000**	**131000**	**53200**
Aroclor 1248	<3240	<4320	<4680	<4710	<5630	<4710	<6380
Aroclor 1254	**17000**	<4320	<4680	<4710	**24500**	<4710	**17700**
Aroclor 1260	<3240	<4320	<4680	<4710	<5630	<4710	<6380
Total PCBs[1]	**114000**	**207000**	**490000**	**173000**	**82400**	**131000**	**70900**
Pesticides (µg/kg OC)							
Chlordane[1]	**661**	**1300**	**1940**	**961**	**604**	**863**	**864**
Dieldrin	**1140**	**2850**	**547**	**2690**	<563	**3660**	<638

Table A3.4 Sediment chemistry data used to assess injury to human uses of fishery resources (USEPA 1996a; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IH 01 05	IH 01 06	IH 01 07	IH 01 08	IH 01 10	IH 01 03	IH 01 04
Pesticides (µg/kg OC; cont.)							
Endrin	<324	<432	502	<471	<563	<471	<638
Heptachlor	**480**	**864**	**3650**	**711**	<563	<627	<638
Heptachlor epoxide	**910**	**2760**	**3080**	**2500**	**645**	<471	<638
Lindane	<324	<432	<468	<471	<563	<471	<638
p,p'-DDD	<324	<432	**798**	<471	<563	<471	<638
p,p'-DDE	**778**	**864**	**2390**	**749**	**776**	**641**	<638
p,p'-DDT	**342**	**864**	<468	**961**	<563	<471	<638
Toxic Equivalents (no units)							
TCDD-TEQ[1]	**0.207**	**3.16**	**6.2**	**2.47**	**1.45**	**3.34**	**0.51**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; IH = Indiana Harbor; LM = Lake Michigan; LGB = Lake George Branch; TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.5 Sediment chemistry data used to assess injury to human uses of fishery resources (Hoke et al. 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**UG-3**	**UG-4**	**UG-5**	**UG-6**	**UG-1**	**UG-2**	**UG-7**	**UG-8**	**UG-9**	**UG-10**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR II	EBGCR II	IHC	WBGCR I	WBGCR II	WBGCR II
Sampling Year	1990	1990	1990	1990	1990	1990	1990	1990	1990	1990
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.60829	41.61213	41.612	41.61552	41.60837	41.60953	41.61824	41.61474	41.61653	41.62592
Longitude	-87.39604	-87.42734	-87.44414	-87.46761	-87.31184	-87.34734	-87.47106	-87.47554	-87.48994	-87.52284
Percent TOC	7.2	12.5	14.3	15.9	28.1	4.4	14.7	22.3	18.8	13.4
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**29700**	**4640**	**10000**	**1040**	**9360**	**38200**	**3610**	**11900**	**8780**	**1270**
Benzo(a)pyrene	**234000**	**67500**	**319000**	**56200**	**96800**	**460000**	**12600**	**375000**	**533000**	**243000**
Benzo(k)fluoranthene	**84700**	**13100**	**28200**	**23200**	**11200**	**95000**	**22200**	**26100**	**11600**	**23100**
Chrysene	**48100**	**6640**	**29400**	**7230**	**7440**	**80900**	**20100**	**11800**	**27700**	**19200**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1248	**95700**	**7520**	**128000**	**10400**	**7720**	**33900**	**29000**	**12600**	**24500**	**59200**
Total PCBs[1]	**95700**	**7520**	**128000**	**10400**	**7720**	**33900**	**29000**	**12600**	**24500**	**59200**
Pesticides (µg/kg OC)										
Chlordane[1]	**17100**	**400**	**629**	**10300**	**3700**	**10000**	**12900**	**10800**	**11600**	**16000**
Dieldrin	**10000**	**320**	**559**	**5850**	**747**	**17300**	**4220**	**179**	**17100**	**8510**
Heptachlor	**36900**	**2880**	**8670**	**3270**	**3490**	**9550**	**9320**	**1970**	**9150**	**1420**
Lindane	**25400**	**11400**	**2030**	**2390**	**1210**	**4770**	**4350**	**3540**	**16800**	**1940**
p,p'-DDD	<139	<80.0	**4340**	**1070**	**142**	**1820**	**68**	**1030**	**53.2**	<74.6
p,p'-DDE	**34600**	**5680**	**10800**	**26600**	**8750**	**55900**	**19700**	**7980**	**24700**	**20200**
p,p'-DDT	**20000**	**2000**	**5240**	**6350**	**819**	**15200**	**5650**	**2470**	**9310**	**672**

Table A3.5 Sediment chemistry data used to assess injury to human uses of fishery resources (Hoke et al. 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	UG-3	UG-4	UG-5	UG-6	UG-1	UG-2	UG-7	UG-8	UG-9	UG-10
Toxic Equivalents (no units)										
TCDD-TEQ[1]	0.0000208	0.000016	0.0000867	0.000022	0.0000221	0.0000227	0.0000034	0.0000157	0.0000388	0.0000545

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC-SD-XX-036/36A	GC-SD-XX-037/37A	GC-SD-XX-037/37B	GC-SD-XX-038/38A	GC-SD-XX-038/38B	GC-SD-XX-039/39A	GC-SD-XX-040/40A	GC-SD-XX-040/40B	GC-SD-XX-041/41A	GC-SD-XX-041/41B
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	0-7.9	8-12.9	0-7.9	8-12.9
Latitude	41.6097	41.609	41.609	41.6087	41.6087	41.60878	41.60973	41.60973	41.6092	41.6092
Longitude	-87.3867	-87.388	-87.388	-87.3889	-87.3889	-87.39791	-87.4085	-87.4085	-87.4112	-87.4112
Percent TOC	2.1	1.3	2.2	2.225	1.5	3.1	3.1	7	4	3
Percent Moisture	47.1	42.9	46.9	39.4125	37.7	49.725	42.15	46.7	51.8	35.9
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	1290	<19200	<455	<27000	<1330	<645	**28800**	**34500**	<500	<667
Benz[a]anthracene	**158000**	<424000	<375000	**224000**	<277000	<439000	**684000**	**323000**	<155000	<174000
Benzo(a)pyrene	**98600**	<565000	<500000	**222000**	<370000	<587000	**487000**	**203000**	<206000	<232000
Benzo(k)fluoranthene	**72400**	<565000	<500000	<380000	<370000	<587000	**442000**	**166000**	<206000	<232000
Chrysene	**193000**	<424000	<375000	**231000**	<277000	<439000	**710000**	**337000**	<155000	<174000
Dibenz[a,h]anthracene	<87100	<678000	<600000	<454000	<444000	<703000	<419000	<150000	<248000	<278000
Indeno(1,2,3-c,d)pyrene	**108000**	<678000	<600000	<454000	<444000	<703000	<419000	<150000	<248000	<278000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	NR	<7690	<4550	<4490	<6670	<3230	<32300	NR	NR	<3330
Aroclor 1242	NR	<7690	<4550	<4490	<6670	<3230	<32300	NR	NR	<3330
Aroclor 1248	NR	**108000**	<4550	**8990**	<6670	<3230	**1500000**	NR	NR	**84000**
Aroclor 1254	NR	<7690	<4550	**8430**	<6670	<3230	<32300	NR	NR	<3330
Aroclor 1260	NR	<7690	<4550	<4490	<6670	<3230	<32300	NR	NR	<3330
Total PCBs[1]	NR	**108000**	NR	**17400**	NR	NR	**1500000**	NR	NR	**84000**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC-SD-XX-042/42A**	**GC-SD-XX-042/42B**	**GC-SD-XX-043/43A**	**GC-SD-XX-043/43B**	**GC-SD-XX-044/44A**	**GC-SD-XX-044/44B**	**GC-SD-XX-045/45A**	**GC-SD-XX-045/45B**	**GC-SD-XX-048/48A**	**GC-SD-XX-048/48B**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9
Latitude	41.6092	41.6092	41.6131	41.6131	41.61315	41.61315	41.6133	41.6133	41.61247	41.61247
Longitude	-87.4115	-87.4115	-87.4321	-87.4321	-87.43239	-87.43239	-87.4341	-87.4341	-87.45117	-87.45117
Percent TOC	5.15	2.7	5.4	4.85	2.6	4.15	4.2	2.1	2.2	7.2
Percent Moisture	44.425	38.4	60.7	58.75	57.4	63.1	35.3	55.3	58.025	72.1
Polycyclic Aromatic Hydrocarbons (μg/kg OC)										
Benzene	<11700	<7410	2910	454	4360	735	<143000	<476	<909	<139
Benz[a]anthracene	**140000**	<187000	<108000	<98100	**320000**	**181000**	**2430000**	<221000	<518000	<158000
Benzo(a)pyrene	<194000	<250000	<144000	<131000	**242000**	**177000**	**1880000**	<295000	<691000	<211000
Benzo(k)fluoranthene	<194000	<250000	<144000	<131000	**216000**	**166000**	**1430000**	<295000	<691000	<211000
Chrysene	**169000**	<187000	**117000**	<98100	**402000**	**200000**	**2270000**	<221000	<518000	<158000
Dibenz[a,h]anthracene	<233000	<300000	<173000	<157000	<323000	<233000	<166000	<354000	<827000	<253000
Indeno(1,2,3-c,d)pyrene	<233000	<300000	<173000	<157000	<323000	<233000	**1130000**	<354000	<827000	<253000
Polychlorinated Biphenyls (μg/kg OC)										
Aroclor 1016	<1940	<3700	<1850	<2060	<3850	<2410	<2380	<4760	<4550	<1390
Aroclor 1242	<1940	<3700	<1850	<2060	<3850	<2410	<2380	<4760	<4550	<1390
Aroclor 1248	**17300**	<3700	<1850	<2060	<3850	<2410	**42400**	<4760	<4550	<1390
Aroclor 1254	<1940	<3700	<1850	<2060	<3850	<2410	<2380	<4760	<4550	<1390
Aroclor 1260	<1940	<3700	<1850	<2060	<3850	<2410	<2380	<4760	<4550	<1390
Total PCBs[1]	**17300**	NR	NR	NR	NR	NR	**42400**	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC-SD-XX-049/49A	GC-SD-XX-049/49B	GC-SD-XX-049/49C	GC-SD-XX-050/50A	GC-SD-XX-050/50B	GC-SD-XX-052/52A	GC-SD-XX-052/52B	GC-SD-XX-001/01A	GC-SD-XX-002/02A	GC-SD-XX-003/03A
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	8-12.9	13-?	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	0-7.9	0-7.9
Latitude	41.6167	41.6167	41.6167	41.61639	41.61639	41.6144	41.6144	41.6085	41.6085	41.6085
Longitude	-87.4552	-87.4552	-87.4552	-87.46011	-87.46011	-87.4613	-87.4613	-87.3012	-87.3042	-87.3069
Percent TOC	5.8	7.4	6.7	3.85	1.1	3.1	3.2	4.2	2.2	9.4
Percent Moisture	41.4	63	70.7	56.4	41.8	54.75	66.2	31.7	20.15	49.3
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	<345	<135	<149	961	<909	<645	<312	**37900**	**632000**	**162000**
Benz[a]anthracene	**422000**	<133000	<193000	**397000**	<460000	<266000	<356000	**379000**	**93200**	**270000**
Benzo(a)pyrene	<178000	<178000	<257000	**373000**	<614000	<355000	<475000	**426000**	**127000**	**294000**
Benzo(k)fluoranthene	<178000	<178000	<257000	**273000**	<614000	<355000	<475000	<383000	**87300**	**228000**
Chrysene	**955000**	<133000	<193000	**588000**	<460000	<266000	<356000	**405000**	**132000**	**353000**
Dibenz[a,h]anthracene	<214000	<214000	<307000	<366000	<736000	<426000	<569000	<460000	<54500	**114000**
Indeno(1,2,3-c,d)pyrene	<214000	<214000	<307000	<366000	<736000	<426000	<569000	<460000	**73600**	<12800
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<1720	<1350	<1490	<2600	<9090	<3230	<3120	<23800	<4550	<1060
Aroclor 1242	<1720	<1350	<1490	<2600	<9090	<3230	<3120	<23800	<4550	<1060
Aroclor 1248	<1720	<1350	<1490	**95800**	<9090	<3230	<3120	**179000**	**45500**	**62000**
Aroclor 1254	<1720	<1350	<1490	<2600	<9090	<3230	<3120	<23800	<4550	<1060
Aroclor 1260	<1720	<1350	<1490	<2600	<9090	<3230	<3120	<23800	<4550	<1060
Total PCBs[1]	NR	NR	NR	**95800**	NR	NR	NR	**179000**	**45500**	**62000**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC-SD-XX-003/03B**	**GC-SD-XX-004/04A**	**GC-SD-XX-004/04B**	**GC-SD-XX-005/05A**	**GC-SD-XX-005/05B**	**GC-SD-XX-006/06A**	**GC-SD-XX-006/06B**	**GC-SD-XX-007/07A**	**GC-SD-XX-007/07B**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9
Latitude	41.6085	41.6086	41.6086	41.6082	41.6082	41.608	41.608	41.6076	41.6076
Longitude	-87.3069	-87.3109	-87.3109	-87.3144	-87.3144	-87.3176	-87.3176	-87.3211	-87.3211
Percent TOC	4.6	9.2	6.5	10.4	5	10	1.2	10.1	12
Percent Moisture	44.1	46	36.1	50.25	34.9	58.05	28.1	60.8	38.2
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benzene	**135000**	**7590000**	**7980000**	**3430000**	**3020000**	**2070000**	**11600000**	**2750000**	**883000**
Benz[a]anthracene	**5650000**	**9460000**	**1530000**	**9380000**	**18600000**	**4500000**	**50800000**	**13900000**	**313000**
Benzo(a)pyrene	**5220000**	**7610000**	**1270000**	**7550000**	**15200000**	**4500000**	**52500000**	**9210000**	**219000**
Benzo(k)fluoranthene	**4350000**	**6520000**	**809000**	**4760000**	**13000000**	**3900000**	**44200000**	**8710000**	**200000**
Chrysene	**6520000**	**10400000**	**1850000**	**4950000**	**10000000**	**2400000**	**25800000**	**13900000**	**333000**
Dibenz[a,h]anthracene	**957000**	**1520000**	**243000**	**745000**	**1280000**	<3000000	<25000000	<1190000	<68300
Indeno(1,2,3-c,d)pyrene	**2830000**	**4670000**	**723000**	**3650000**	**7000000**	<3000000	**29200000**	**6440000**	**175000**
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1016	<21700	<10900	<1540	<9620	<20000	<20000	<83300	<9900	<8330
Aroclor 1242	<21700	<10900	<1540	<9620	<20000	<20000	<83300	<9900	<8330
Aroclor 1248	**5240000**	**2040000**	**772000**	**990000**	**1680000**	**882000**	**5490000**	**24300**	**213000**
Aroclor 1254	<21700	<10900	<1540	**160000**	**258000**	<20000	**658000**	<9900	<8330
Aroclor 1260	<21700	<10900	<1540	<9620	<20000	<20000	<83300	<9900	<8330
Total PCBs[1]	**5240000**	**2040000**	**772000**	**1150000**	**1940000**	**882000**	**6150000**	**24300**	**213000**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC-SD-XX-008/08A**	**GC-SD-XX-008/08B**	**GC-SD-XX-009/09A**	**GC-SD-XX-009/09B**	**GC-SD-XX-010/10A**	**GC-SD-XX-010/10B**	**GC-SD-XX-011/11A**	**GC-SD-XX-012/12A**	**GC-SD-XX-013/13A**	**GC-SD-XX-014/14A**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	0-7.9	0-7.9	0-7.9
Latitude	41.6076	41.6076	41.6076	41.6076	41.6076	41.6076	41.6076	41.6077	41.6077	41.6076
Longitude	-87.3229	-87.3229	-87.3244	-87.3244	-87.3266	-87.3266	-87.3282	-87.3303	-87.3317	-87.3332
Percent TOC	16.73	5.79	16.7	1.8	8.2	1.3	2.3	1.6	1.2	2.37
Percent Moisture	47.15	36.9	53.1	15.7	42.5	16.8	35	22.9	25.9	26.25
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	**163000**	**3130000**	**1710000**	**7440000**	**2820000**	**7460000**	<174000	<50000	**40600**	<422
Benz[a]anthracene	**717000**	**18400000**	**5990000**	**6670000**	**11600000**	**19200000**	**25800000**	**2710000**	**13100000**	**116000**
Benzo(a)pyrene	**458000**	**14100000**	**3410000**	**4650000**	**6410000**	**12500000**	**16700000**	**1770000**	**7170000**	**78100**
Benzo(k)fluoranthene	**403000**	**11900000**	**2570000**	**4480000**	**4160000**	**9310000**	**12300000**	**1170000**	**5660000**	**69600**
Chrysene	**736000**	**19000000**	**5750000**	**6670000**	**11000000**	**19400000**	**25500000**	**2520000**	**12500000**	**58500**
Dibenz[a,h]anthracene	**85200**	**1810000**	**556000**	<3940000	<1280000	<4690000	<4690000	<1110000	<1480000	<50600
Indeno(1,2,3-c,d)pyrene	**361000**	**10500000**	**2510000**	**4030000**	**5220000**	**9770000**	**14700000**	**1240000**	**4330000**	**42200**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<5980	<17300	<5990	<55600	<12200	NR	<43500	NR	<83300	<4220
Aroclor 1242	<5980	<17300	<5990	<55600	<12200	NR	<43500	NR	<83300	<4220
Aroclor 1248	**129000**	**2960000**	**123000**	<55600	**4170000**	NR	**830000**	NR	**1130000**	**78100**
Aroclor 1254	<5980	<17300	<5990	<55600	<12200	NR	<43500	NR	<83300	<4220
Aroclor 1260	<5980	<17300	<5990	<55600	<12200	NR	<43500	NR	<83300	<4220
Total PCBs[1]	**129000**	**2960000**	**123000**	NR	**4170000**	NR	**830000**	NR	**1130000**	**78100**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC-SD-XX-015/15A**	**GC-SD-XX-016/16A**	**GC-SD-XX-016/16B**	**GC-SD-XX-017/17A**	**GC-SD-XX-017/17B**	**GC-SD-XX-018/18A**	**GC-SD-XX-018/18B**	**GC-SD-XX-019/19A**	**GC-SD-XX-019/19B**	**GC-SD-XX-020/20A**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9
Latitude	41.6077	41.6079	41.6079	41.6086	41.6086	41.6093	41.6093	41.6098	41.6098	41.61
Longitude	-87.3353	-87.3385	-87.3385	-87.3394	-87.3394	-87.3401	-87.3401	-87.3412	-87.3412	-87.3428
Percent TOC	2.7	3.6	1.6	3.4	5.1	4.95	2.1	2.1	2.8	2.8
Percent Moisture	36.95	42.3	29.5	35.95	48.9	46.4	31.6	33.3	40.5	48.2
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	<111000	**15300**	<18700	<176000	<118000	<60600	<14300	<14300	**9210**	**12300**
Benz[a]anthracene	**1000000**	**333000**	**4440000**	**14100000**	**4710000**	**2220000**	**1180000**	**1370000**	**282000**	**457000**
Benzo(a)pyrene	**685000**	**200000**	**3310000**	**9120000**	**3330000**	**1520000**	**857000**	**1150000**	**225000**	**361000**
Benzo(k)fluoranthene	**626000**	**183000**	**3600000**	**5880000**	**3140000**	**1490000**	**614000**	**910000**	**229000**	**300000**
Chrysene	**511000**	**189000**	**2460000**	**7350000**	**2350000**	**1140000**	**581000**	**667000**	**179000**	**239000**
Dibenz[a,h]anthracene	**122000**	<33300	<750000	**2150000**	**588000**	**99000**	**176000**	**152000**	**71400**	**78600**
Indeno(1,2,3-c,d)pyrene	**411000**	**100000**	**1490000**	**6470000**	**1720000**	**706000**	**590000**	**805000**	**179000**	**225000**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<3700	<2780	<6250	<2940	<1960	<2020	<4760	<4760	<3570	<3570
Aroclor 1242	<3700	<2780	<6250	<2940	<1960	<2020	<4760	<4760	<3570	<3570
Aroclor 1248	<3700	**35800**	**494000**	**1620000**	**62700**	**153000**	**475000**	**1200000**	<3570	**107000**
Aroclor 1254	<3700	<2780	<6250	**206000**	**19600**	<2020	<4760	<4760	<3570	**42900**
Aroclor 1260	<3700	<2780	<6250	<2940	<1960	<2020	<4760	<4760	<3570	<3570
Total PCBs[1]	NR	**35800**	**494000**	**1820000**	**82400**	**153000**	**475000**	**1200000**	NR	**150000**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC-SD-XX-021/21A**	**GC-SD-XX-022/22A**	**GC-SD-XX-023/23A**	**GC-SD-XX-023/23B**	**GC-SD-XX-024/24A**	**GC-SD-XX-024/24B**	**GC-SD-XX-025/25A**	**GC-SD-XX-025/25B**	**GC-SD-XX-025/25C**	**GC-SD-XX-026/26A**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	0-7.9	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	13-?	0-7.9
Latitude	41.6096	41.6088	41.6079	41.6079	41.6074	41.6074	41.607	41.607	41.607	41.6073
Longitude	-87.3472	-87.3488	-87.3501	-87.3501	-87.3519	-87.3519	-87.3539	-87.3539	-87.3539	-87.3585
Percent TOC	2.5	11	3.3	1.2	4.4	3	3.5	1.6	3.7	1.6
Percent Moisture	40.9	31.95	33.5	21.4	55.3	35.7	42.2	39.6	45.5	37.4
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	<400	**9450**	<1210	4420	<13600	<667	<28600	<250000	297	<1250
Benz[a]anthracene	**56000**	**639000**	**485000**	**708000**	**132000**	**143000**	**4860000**	**444000**	**114000**	**231000**
Benzo(a)pyrene	**48000**	**536000**	**379000**	**600000**	**114000**	**110000**	**4000000**	**387000**	**97300**	**194000**
Benzo(k)fluoranthene	<40000	**435000**	**306000**	**392000**	**79500**	**93300**	**3430000**	**294000**	**81100**	**162000**
Chrysene	**32800**	**317000**	**270000**	**392000**	**77300**	**90000**	**2540000**	**5240000**	**67600**	**131000**
Dibenz[a,h]anthracene	<48000	**90000**	<36400	**100000**	<27300	<40000	**371000**	<75000	<32400	<75000
Indeno(1,2,3-c,d)pyrene	<48000	**265000**	**176000**	**433000**	**81800**	**80000**	**1840000**	**219000**	**73000**	**112000**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<4000	<909	<3030	<8330	<2270	<3330	<28600	<6250	<27000	<6250
Aroclor 1242	<4000	<909	<3030	<8330	<2270	<3330	<28600	<6250	<27000	<6250
Aroclor 1248	**148000**	**19100**	**45200**	**373000**	**12700**	<3330	**291000**	<6250	<27000	**93700**
Aroclor 1254	<4000	**8180**	<3030	<8330	<2270	<3330	**51400**	<6250	<27000	<6250
Aroclor 1260	<4000	<909	<3030	<8330	<2270	<3330	<28600	<6250	<27000	<6250
Total PCBs[1]	**148000**	**27300**	**45200**	**373000**	**12700**	NR	**343000**	NR	NR	**93700**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC-SD-XX-026/26B**	**GC-SD-XX-026/26C**	**GC-SD-XX-027/27A**	**GC-SD-XX-027/27B**	**GC-SD-XX-028/28A**	**GC-SD-XX-029/29A**	**GC-SD-XX-029/29B**	**GC-SD-XX-030/30A**	**GC-SD-XX-031/31A**	**GC-SD-XX-031/31B**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	8-12.9	13-?	0-7.9	8-12.9	0-7.9	0-7.9	8-12.9	0-7.9	0-7.9	8-12.9
Latitude	41.6073	41.6073	41.608	41.608	41.6087	41.6087	41.6087	41.6091	41.6066	41.6066
Longitude	-87.3585	-87.3585	-87.361	-87.361	-87.3637	-87.3681	-87.3681	-87.3724	-87.3769	-87.3769
Percent TOC	1.6	4.7	3.8	3.3	4.1	6.45	4.85	2.23	2.395	2.63
Percent Moisture	40.9	56.5	47	50.6	50.8	49.5	53.2	42.4	53.8	49.9
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	1310	1300	<26300	<1210	854	550	<825	942	731	<760
Benz[a]anthracene	**137000**	**279000**	**321000**	**694000**	**768000**	**405000**	**295000**	**3630000**	**1180000**	**185000**
Benzo(a)pyrene	**93700**	**230000**	<342000	**745000**	**568000**	**259000**	**149000**	**2430000**	**657000**	**121000**
Benzo(k)fluoranthene	**93700**	**177000**	<342000	**561000**	**322000**	**173000**	**125000**	**1810000**	**453000**	**97000**
Chrysene	**106000**	**155000**	<258000	**376000**	**744000**	**390000**	**349000**	**3850000**	**1100000**	**222000**
Dibenz[a,h]anthracene	<75000	<48900	<421000	<576000	**87800**	**29500**	<53600	<852000	**66800**	<76000
Indeno(1,2,3-c,d)pyrene	<75000	**179000**	<421000	<576000	**537000**	**258000**	**133000**	**2100000**	**537000**	**114000**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<6250	<2130	<2630	<3030	NR	<1550	<2060	NR	<41800	<38000
Aroclor 1242	<6250	<2130	<2630	<3030	NR	<1550	<2060	NR	<41800	<38000
Aroclor 1248	<6250	<2130	**240000**	<3030	NR	**89000**	**5770**	NR	<41800	<38000
Aroclor 1254	<6250	<2130	<2630	<3030	NR	<1550	<2060	NR	<41800	<38000
Aroclor 1260	<6250	<2130	<2630	<3030	NR	<1550	<2060	NR	<41800	<38000
Total PCBs[1]	NR	NR	**240000**	NR	NR	**89000**	**5770**	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC-SD-XX-032/32A	GC-SD-XX-032/32B	GC-SD-XX-032/32C	GC-SD-XX-033/33A	GC-SD-XX-033/33B	GC-SD-XX-033/33C	GC-SD-XX-034/34A	GC-SD-XX-034/34B	GC-SD-XX-034/34C	GC-SD-XX-035/35A
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	0-7.9	8-12.9	13-?	0-7.9	8-12.9	13-?	0-7.9	8-12.9	13-?	0-7.9
Latitude	41.6068	41.6068	41.6068	41.6089	41.6089	41.6089	41.6103	41.6103	41.6103	41.6116
Longitude	-87.37963	-87.37963	-87.37963	-87.3806	-87.3806	-87.3806	-87.3807	-87.3807	-87.3807	-87.3852
Percent TOC	5.02	2.56	1.55	6.2	4.6	2.8	6.4	4.8	2.9	5.4
Percent Moisture	58.9	61.7	30	59.05	48.3	50.1	53.3	60.6	56.4	54.8
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	7030	2930	1100	6130	**21500**	<286000	891	<167000	**13200**	**38300**
Benz[a]anthracene	**857000**	**191000**	**355000**	**1110000**	**557000**	**3140000**	**2170000**	**606000**	**386000**	**604000**
Benzo(a)pyrene	**592000**	**102000**	**219000**	**866000**	**252000**	**1440000**	**2000000**	**398000**	**192000**	**231000**
Benzo(k)fluoranthene	**367000**	**85900**	**200000**	**600000**	**215000**	**1240000**	**1500000**	**252000**	**153000**	**159000**
Chrysene	**823000**	**258000**	**445000**	**1140000**	**550000**	**2970000**	**2120000**	**604000**	**417000**	**591000**
Dibenz[a,h]anthracene	**87600**	<82000	<116000	<424000	<52200	<696000	<439000	**51700**	<79700	<45700
Indeno(1,2,3-c,d)pyrene	**576000**	**93800**	**200000**	**679000**	**172000**	**911000**	**1340000**	**408000**	**150000**	**256000**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<19900	NR	<64500	<16100	NR	NR	NR	NR	NR	NR
Aroclor 1242	<19900	NR	<64500	<16100	NR	NR	NR	NR	NR	NR
Aroclor 1248	**77500**	NR	<64500	**182000**	NR	NR	NR	NR	NR	NR
Aroclor 1254	<19900	NR	<64500	<16100	NR	NR	NR	NR	NR	NR
Aroclor 1260	<19900	NR	<64500	<16100	NR	NR	NR	NR	NR	NR
Total PCBs[1]	**77500**	NR	NR	**182000**	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC-SD-XX-035/35B	GC-SD-XX-035/35C	GC-SD-XX-053/53A	GC-SD-XX-053/53B	GC-SD-XX-057/57A	GC-SD-XX-057/57B	GC-SD-XX-058/58A	GC-SD-XX-059/59A	GC-SD-XX-060/60A	GC-SD-XX-061/61A
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	IHC	IHC	IHC	IHC	IHC	IHC	IHC	IHC
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	8-12.9	13-?	0-7.9	8-12.9	0-7.9	8-12.9	0-7.9	0-7.9	0-7.9	0-7.9
Latitude	41.6116	41.6116	41.61808	41.61808	41.61873	41.61873	41.6229	41.62712	41.63125	41.63535
Longitude	-87.3852	-87.3852	-87.47089	-87.47089	-87.47114	-87.47114	-87.47117	-87.47108	-87.47114	-87.47121
Percent TOC	4.6	3.3	0.86	3.2	0.9	1	1.6	1.4	1.07	3.9
Percent Moisture	58.2	60.6	30.4	49.7	30.85	24.6	60	26.6	21.05	51.65
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	**8930**	**33900**	**17200**	<625	**47000**	<30000	<2500	<1430	6730	**69500**
Benz[a]anthracene	**204000**	**403000**	**1150000**	<167000	**3420000**	**1080000**	**1180000**	**1060000**	**594000**	**390000**
Benzo(a)pyrene	**89200**	**266000**	<628000	<223000	**2920000**	<555000	**806000**	<943000	<1010000	<305000
Benzo(k)fluoranthene	**54600**	**213000**	**650000**	<223000	**2100000**	<555000	**552000**	<943000	<1010000	<305000
Chrysene	**239000**	**473000**	**1720000**	<167000	**4010000**	**1920000**	**2460000**	**1190000**	**975000**	**518000**
Dibenz[a,h]anthracene	<50400	<80900	<753000	<268000	<1280000	<666000	<495000	<1130000	<1210000	<367000
Indeno(1,2,3-c,d)pyrene	**96200**	**283000**	<753000	<268000	**1510000**	<666000	<495000	<1130000	<1210000	<367000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<2170	<3030	<11600	<3120	<11100	NR	<6250	<7140	<9350	<2560
Aroclor 1242	<2170	<3030	<11600	<3120	<11100	NR	<6250	<7140	<9350	<2560
Aroclor 1248	**123000**	<3030	<11600	<3120	**283000**	NR	**650000**	<7140	<9350	<2560
Aroclor 1254	<2170	<3030	<11600	<3120	<11100	NR	<6250	<7140	<9350	<2560
Aroclor 1260	<2170	<3030	<11600	<3120	<11100	NR	<6250	<7140	<9350	<2560
Total PCBs[1]	**123000**	NR	NR	NR	**283000**	NR	**650000**	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC-SD-XX-061/61B	GC-SD-XX-062/62A	GC-SD-XX-062/62B	GC-SD-XX-054/54A	GC-SD-XX-054/54B	GC-SD-XX-054/54C	GC-SD-XX-055/55A	GC-SD-XX-055/55B	GC-SD-XX-055/55C	GC-SD-XX-056/56A
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	IHC	IHC	IHC	WBGCR I	WBGCR I	WBGCR I	WBGCR I	WBGCR I	WBGCR I	WBGCR I
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	8-12.9	0-7.9	8-12.9	0-7.9	8-12.9	13-?	0-7.9	8-12.9	13-?	0-7.9
Latitude	41.63535	41.6385	41.6385	41.61803	41.61803	41.61803	41.61409	41.61409	41.61409	41.6142
Longitude	-87.47121	-87.4712	-87.4712	-87.47142	-87.47142	-87.47142	-87.47974	-87.47974	-87.47974	-87.4801
Percent TOC	0.95	13	11.45	4.3	4.1	3.9	4.75	2.85	2	1.3
Percent Moisture	31.2	57.1	42.2	50.2	57.1	67.4	58.575	51.4	50.4	69.2
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	3580	1370	380	**22400**	**42200**	1540	5740	<10500	<500	<30800
Benz[a]anthracene	<643000	**242000**	**406000**	**765000**	<226000	<272000	**3940000**	<342000	<426000	**1410000**
Benzo(a)pyrene	<858000	**166000**	**303000**	**388000**	<302000	<362000	**974000**	<456000	<570000	<650000
Benzo(k)fluoranthene	<858000	**131000**	**199000**	<270000	<302000	<362000	**682000**	<456000	<570000	<650000
Chrysene	**805000**	**368000**	**602000**	**1800000**	<226000	<272000	**6540000**	**380000**	<426000	**2950000**
Dibenz[a,h]anthracene	<1030000	<77700	**58400**	<323000	<361000	<433000	**337000**	<547000	<680000	<777000
Indeno(1,2,3-c,d)pyrene	<1030000	**97700**	**185000**	<323000	<361000	<433000	**314000**	<547000	<680000	<777000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10500	<769	<873	<2330	<2440	<2560	<2110	<3510	<5000	<7690
Aroclor 1242	<10500	<769	<873	<2330	<2440	<2560	<2110	<3510	<5000	<7690
Aroclor 1248	<10500	<769	**34500**	<2330	<2440	<2560	<2110	<3510	<5000	<7690
Aroclor 1254	<10500	<769	<873	<2330	<2440	<2560	<2110	<3510	<5000	<7690
Aroclor 1260	<10500	<769	<873	<2330	<2440	<2560	<2110	<3510	<5000	<7690
Total PCBs[1]	NR	NR	**34500**	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.6 Sediment chemistry data used to assess injury to human uses of fishery resources (Floyd-Browne 1993; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC-SD-XX-056/56B	GC-SD-XX-056/56C
Geographic Area	GCR/IHC	GCR/IHC
Reach	WBGCR I	WBGCR I
Sampling Year	1991	1991
Depth (ft)	8-12.9	13-?
Latitude	41.6142	41.6142
Longitude	-87.4801	-87.4801
Percent TOC	6.9	4.9
Percent Moisture	66.2	65.5
Polycyclic Aromatic Hydrocarbons (µg/kg OC)		
Benzene	**8610**	<408
Benz[a]anthracene	**396000**	<196000
Benzo(a)pyrene	**267000**	<261000
Benzo(k)fluoranthene	**249000**	<261000
Chrysene	**610000**	<196000
Dibenz[a,h]anthracene	<188000	<314000
Indeno(1,2,3-c,d)pyrene	<188000	<314000
Polychlorinated Biphenyls (µg/kg OC)		
Aroclor 1016	<1450	<2040
Aroclor 1242	<1450	<2040
Aroclor 1248	<1450	<2040
Aroclor 1254	<1450	<2040
Aroclor 1260	<1450	<2040
Total PCBs[1]	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; IHC = Indiana Harbor Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.7 Sediment chemistry data used to assess injury to human uses of fishery resources (USEPA 1991; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**S08**	**S09**	**S10**	**S11**	**D11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	USC	USC	USC	USC	USC	USC	USC	USC	USC	USC	USC	USC
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.65942	41.65883	41.65818	41.65554	41.65554	41.65481	41.65377	41.65304	41.65206	41.65104	41.64856	41.64823
Longitude	-87.45333	-87.45407	-87.45573	-87.45943	-87.45943	-87.46023	-87.46056	-87.4618	-87.4631	-87.46642	-87.46892	-87.46875
Percent TOC	4.1	31	37	28	18	17	38	12	26	23	22	23
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (μg/kg OC)												
Benz[a]anthracene	**163000**	**58100**	**97300**	**4640**	**22800**	**20600**	**145000**	**158000**	**92300**	**87000**	**114000**	**95700**
Benzo(a)pyrene	**129000**	**41900**	**64900**	**7140**	**22800**	**19400**	**145000**	**91700**	**80800**	**91300**	**118000**	**113000**
Benzo(k)fluoranthene	**56100**	**11900**	**19700**	**2750**	**10000**	**5590**	**60500**	**39200**	**42300**	**35700**	**54500**	**60900**
Chrysene	**17100**	**74200**	**130000**	**7140**	**41700**	**31800**	**211000**	**225000**	**131000**	**126000**	**159000**	**135000**
Dibenz[a,h]anthracene	**19300**	**8060**	**8920**	<17500	<20000	<25300	**19700**	**18300**	**12700**	**13000**	**18600**	**11700**
Indeno(1,2,3-c,d)pyrene	**82900**	**24200**	**37800**	**5710**	<20000	**10600**	**92100**	**66700**	**57700**	**73900**	**95500**	**87000**

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal;
IH = Indiana Harbor; LM = Lake Michigan; USC = United States Canal.

Table A3.7 Sediment chemistry data used to assess injury to human uses of fishery resources (USEPA 1991; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**S19**	**S01**	**S02**	**S03**	**S04**	**D04**	**S05**	**S06**	**S07**
Geographic Area	GCR/IHC	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM
Reach	USC	IH	IH	IH	IH	IH	IH	IH	IH
Sampling Year	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.64979	41.66865	41.66617	41.66536	41.66484	41.66484	41.66567	41.66693	41.66886
Longitude	-87.46766	-87.43647	-87.43829	-87.43798	-87.438	-87.438	-87.43906	-87.44065	-87.43814
Percent TOC	23	31	27	15	18	32	16	18	17
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (μg/kg OC)									
Benz[a]anthracene	**65200**	**41900**	**21500**	**66700**	**167000**	**71900**	**81300**	**49400**	**52900**
Benzo(a)pyrene	**82600**	**22900**	**20400**	**73300**	**139000**	**65600**	**62500**	**54400**	**22900**
Benzo(k)fluoranthene	**33500**	**8390**	**9630**	**28000**	**51700**	**26600**	**24400**	**17200**	**6470**
Chrysene	**91300**	**48400**	**33300**	**66700**	**183000**	**100000**	**93800**	**61100**	**64700**
Dibenz[a,h]anthracene	**14800**	**5480**	**5190**	<47300	**23900**	**11600**	**12500**	<41100	**5590**
Indeno(1,2,3-c,d)pyrene	**60900**	**13500**	**14400**	**58700**	**94400**	**53100**	**41900**	**40600**	**12400**

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal;
IH = Indiana Harbor; LM = Lake Michigan; USC = United States Canal.

Table A3.8 Sediment chemistry data used to assess injury to human uses of fishery resources (IDEM 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**085-94**	**086-94**	**025-90**	**026-90**	**033-92**	**063-94**	**064-94**	**087-94**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	USC	USC	USC	USC	USC	WBGCR II
Sampling Year	1994	1994	1990	1990	1992	1994	1994	1994
Depth (ft)	Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Latitude	41.61409	41.61409	41.65525	41.65525	41.65525	41.65525	41.65525	41.6144
Longitude	-87.4614	-87.4614	-87.4592	-87.4592	-87.4592	-87.4592	-87.4592	-87.4806
Percent TOC	10.52	10.4	9.37	11.53	9.065	15.86	10.36	18.64
Percent Moisture	54.5	62.5	53	48	52.5	69.4	55.9	74.8
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benzene	NR	NR	331	217	1070	NR	NR	NR
Benz[a]anthracene	**209000**	**96200**	**171000**	**104000**	**205000**	**47300**	**78200**	**59000**
Benzo(a)pyrene	**171000**	**32700**	**104000**	**83300**	**90500**	**61800**	**59800**	**24700**
Benzo(k)fluoranthene	<171000	**58700**	<149000	<113000	**74300**	**29600**	**29900**	**34900**
Chrysene	**447000**	**38500**	**203000**	**147000**	**1550000**	**94600**	**174000**	**24100**
Dibenz[a,h]anthracene	**22800**	**21200**	<149000	<113000	**19700**	**13200**	**13500**	**11300**
Indeno(1,2,3-c,d)pyrene	**44700**	**15400**	**65100**	**45100**	**124000**	**26500**	**22200**	**14500**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<20900	<12800	<227	<167	<58600	<8240	<8750	<10600
Aroclor 1242	<20900	<12800	**145000**	**155000**	<58600	<8240	<8750	<10600
Aroclor 1248	**148000**	**97400**	<227	<167	**204000**	**45300**	**125000**	**42600**
Aroclor 1254	<20900	<12800	**36300**	**35000**	<58600	<8240	<8750	<10600
Aroclor 1260	<20900	<12800	**3180**	**2500**	<58600	<8240	<8750	<10600
Total PCBs[1]	**148000**	**97400**	**185000**	**193000**	**204000**	**45300**	**125000**	**42600**
Pesticides (µg/kg OC)								
Chlordane[1]	NR	NR	**1360**	**367**	NR	**824**	**1570**	NR

Table A3.8 Sediment chemistry data used to assess injury to human uses of fishery resources (IDEM 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	085-94	086-94	025-90	026-90	033-92	063-94	064-94	087-94
Pesticides (µg/kg OC)								
Dieldrin	<418	<257	**318**	**167**	<1170	**577**	**219**	<575
Endrin	<4180	<2560	<1700	<1250	<11700	<206	136	<2130
Heptachlor	<2090	<1280	<568	<417	<5860	**556**	**1930**	<1060
Heptachlor epoxide	<1610	<2030	<863	<634	<5860	**1650**	**3500**	<1060
Lindane	<418	<257	<171	<125	<1170	<20.8	**153**	<213
p,p'-DDD	<836	<512	**908**	**717**	<2340	**268**	**482**	**958**
p,p'-DDE	<1150	<795	<227	<167	<2340	**701**	**1360**	<958
p,p'-DDT	<836	<512	<568	<417	<2340	**289**	**306**	<426

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, WBGCR = West Branch of the Grand Calumet River; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.9 Sediment chemistry data used to assess injury to human uses of fishery resources (Burton 1994; Dorkin 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**COL1-13**	**COL2-37**	**COL2-38**	**COL2-39**	**COL2-40**	**COL2-41**	**COL2-42**	**COL2-46**	**COL2-47**	**MOL1-17**	**MOL2-48**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	0-1	0-3	3-6	6-7.2	0-3	3-6	6-7.1	0-3	0-3	0-3	0-3
Latitude	41.61866	41.61866	41.61866	41.61866	41.61866	41.61866	41.61866	41.6186	41.6188	41.6159	41.6159
Longitude	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4938	-87.4938
Percent TOC	1.3	2.2	4.8	7.4	3.4	7.3	6.9	1.4	3.8	11.72	12.5
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)											
Benzene	<5150	NR	NR	NR	NR	NR	NR	NR	NR	<1020	NR
Benz[a]anthracene	**231000**	**159000**	**375000**	**716000**	**353000**	**411000**	**464000**	<857000	**447000**	**358000**	**448000**
Benzo(a)pyrene	**254000**	<300000	**185000**	**311000**	**235000**	**192000**	**232000**	<857000	**237000**	**265000**	**192000**
Benzo(k)fluoranthene	**146000**	<300000	<219000	<446000	<241000	<219000	<319000	<857000	<276000	**58900**	<144000
Chrysene	**262000**	**259000**	**500000**	**757000**	**588000**	**603000**	**522000**	**443000**	**868000**	**734000**	**960000**
Dibenz[a,h]anthracene	<354000	<300000	<219000	<446000	<241000	<219000	<319000	<857000	<276000	<128000	<144000
Indeno(1,2,3-c,d)pyrene	**192000**	<300000	**123000**	<446000	**147000**	**91800**	<319000	<857000	<276000	**73400**	<144000

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

Table A3.9 Sediment chemistry data used to assess injury to human uses of fishery resources (Burton 1994; Dorkin 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	MOL2-50	MOL2-52	MOL2-54	MOL2-56	MOL2-58	MOL2-59	MOL2-60	MOL2-61	MOL2-68	MOL2-70	ROX1-21A
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	3-6	6-9	9-12	12-13	0-3	3-6	6-9	9-11.7	0-3	0-3	0-3
Latitude	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.61595	41.616	41.6163
Longitude	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4903
Percent TOC	9	6.8	8	1.3	15.8	9.7	8.7	5.5	18.1	17.4	8.4
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (μg/kg OC)											
Benzene	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	679
Benz[a]anthracene	**456000**	**83800**	<65000	<154000	**627000**	**47400**	<43700	<65500	**2320000**	**1090000**	**167000**
Benzo(a)pyrene	**244000**	<76500	<65000	<154000	**266000**	**20600**	<43700	<65500	**884000**	**420000**	**143000**
Benzo(k)fluoranthene	<256000	<76500	<65000	<154000	<171000	<25800	<43700	<65500	<298000	**39700**	**21400**
Chrysene	**889000**	**137000**	<65000	<154000	**1330000**	**92800**	**28700**	<65500	**4030000**	**1320000**	**369000**
Dibenz[a,h]anthracene	<256000	<76500	<65000	<154000	<171000	<25800	<43700	<65500	144000	<16700	<131000
Indeno(1,2,3-c,d)pyrene	<256000	<76500	<65000	<154000	<171000	<25800	<43700	<65500	**144000**	**92000**	<131000

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

Table A3.9 Sediment chemistry data used to assess injury to human uses of fishery resources (Burton 1994; Dorkin 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**ROX1-21B**	**ROX2-71**	**ROX2-72**	**ROX2-73**	**ROX2-74**	**ROX2-75**	**ROX2-76**	**ROX2-80**	**ROX2-81**	**ROX2-82**	**ROX2-84**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	0-3	0-3	3-6	6-7.5	0-3	3-6	6-7.7	0-3	0-3	0-3	3-6
Latitude	41.6163	41.6163	41.6163	41.6163	41.6163	41.6163	41.6163	41.61617	41.6164	41.6188	41.6188
Longitude	-87.4903	-87.4903	-87.4903	-87.4903	-87.4903	-87.4903	-87.4903	-87.4902	-87.4903	-87.4864	-87.4864
Percent TOC	6.5	19.2	15.2	9.1	13.4	14.8	10.5	4	8.5	5.8	5.1
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)											
Benzene	<2460	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Benz[a]anthracene	**385000**	**365000**	**289000**	**46200**	**261000**	**203000**	<50500	**173000**	**200000**	<32800	<58800
Benzo(a)pyrene	**200000**	**161000**	**158000**	**27500**	**179000**	**115000**	<50500	**133000**	**119000**	<32800	<58800
Benzo(k)fluoranthene	**29200**	<83300	<138000	<51600	<41000	<50000	<50500	<52500	**16500**	<32800	<58800
Chrysene	**862000**	**781000**	**553000**	**89000**	**343000**	**358000**	<50500	**400000**	**412000**	<32800	<58800
Dibenz[a,h]anthracene	29200	<83300	<138000	<51600	29900	<50000	<50500	17500	<68200	<32800	<58800
Indeno(1,2,3-c,d)pyrene	**41500**	<83300	<138000	<51600	**36600**	**26400**	<50500	**25000**	**22400**	<32800	<58800

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

Table A3.9 Sediment chemistry data used to assess injury to human uses of fishery resources (Burton 1994; Dorkin 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**ROX2-86**	**ROX2-88**	**ROX2-89**	**ROX2-90**	**ROX2-94**	**ROX2-95**	**SOHL1-09**	**SOHL2-21**	**SOHL2-23**	**SOHL2-25**	**SOHL2-27**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	6-7.8	0-3	3-6	6-7.2	0-3	0-3	0-3	0-3	3-6	6-6.5	0-3
Latitude	41.6188	41.6188	41.6188	41.6188	41.6187	41.6188	41.6222	41.6222	41.6222	41.6222	41.6222
Longitude	-87.4864	-87.4864	-87.4864	-87.4864	-87.4864	-87.48642	-87.5127	-87.5127	-87.5127	-87.5127	-87.5127
Percent TOC	4.5	6.7	6.2	4.3	13.3	8.9	1.96	10.7	9.4	6.3	11.3
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (μg/kg OC)											
Benzene	NR	NR	NR	NR	NR	NR	816	NR	NR	NR	NR
Benz[a]anthracene	<68900	<46300	<53200	<55800	**143000**	<52800	**969000**	**1590000**	**883000**	**190000**	**858000**
Benzo(a)pyrene	<68900	<46300	<53200	<55800	**113000**	<52800	**1120000**	**916000**	**489000**	**96800**	**389000**
Benzo(k)fluoranthene	<68900	<46300	<53200	<55800	**241000**	<52800	**474000**	**252000**	<543000	<190000	<407000
Chrysene	<68900	<46300	<53200	<55800	**308000**	<52800	**1070000**	**1780000**	**915000**	**173000**	**850000**
Dibenz[a,h]anthracene	<68900	<46300	<53200	<55800	<241000	<52800	168000	<72000	<543000	<190000	<407000
Indeno(1,2,3-c,d)pyrene	<68900	<46300	<53200	<55800	<241000	<52800	**816000**	**402000**	<543000	<190000	<407000

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

Table A3.9 Sediment chemistry data used to assess injury to human uses of fishery resources (Burton 1994; Dorkin 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	SOHL2-28	SOHL2-29	SOHL2-33	SOHL2-35	SOHL2-96	STATE1-05	STATE2-09	STATE2-13	STATE2-14	STATE2-19
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	3-6	6-7	0-3	3-6	6-7.8	0-3	3-4.3	0-3	3-5.1	0-3
Latitude	41.6222	41.6222	41.6222	41.6222	41.6222	41.62546	41.62546	41.62546	41.62546	41.6254
Longitude	-87.5127	-87.5127	-87.5127	-87.5127	-87.5127	-87.5201	-87.5201	-87.5201	-87.5201	-87.5201
Percent TOC	7.6	5.1	5.1	7.8	6.4	10.1	11.3	13.4	4.6	10.7
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benzene	NR	NR	NR	NR	NR	<1880	NR	NR	NR	NR
Benz[a]anthracene	**421000**	**72500**	**167000**	**436000**	**78100**	**931000**	**1240000**	**679000**	<222000	**738000**
Benzo(a)pyrene	<526000	<118000	**82400**	**231000**	**42200**	**574000**	**575000**	**358000**	<222000	**402000**
Benzo(k)fluoranthene	<526000	<118000	**33300**	<269000	<109000	**168000**	<938000	<724000	<222000	<570000
Chrysene	**434000**	**70600**	**196000**	**487000**	**73400**	**980000**	**1330000**	**694000**	<222000	**1310000**
Dibenz[a,h]anthracene	<526000	<118000	<114000	<269000	<109000	71300	<938000	<724000	<222000	<570000
Indeno(1,2,3-c,d)pyrene	<526000	<118000	**66700**	**141000**	<109000	**228000**	<938000	<724000	<222000	<570000

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

Table A3.9 Sediment chemistry data used to assess injury to human uses of fishery resources (Burton 1994; Dorkin 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	STATE2-20	TORR1-01A	TORR2-01	TORR2-02	TORR2-03
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1993	1993	1993	1993	1993
Depth (ft)	0-3	0-3	0-3	3-6	6-7.5
Latitude	41.6255	41.64554	41.64554	41.64554	41.64554
Longitude	-87.5201	-87.558	-87.558	-87.558	-87.558
Percent TOC	9.3	11.7	11.7	11.7	1.8
Percent Moisture	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)					
Benzene	NR	427	NR	NR	NR
Benz[a]anthracene	**731000**	**316000**	**214000**	**171000**	<200000
Benzo(a)pyrene	**387000**	**239000**	**162000**	**75200**	<200000
Benzo(k)fluoranthene	**129000**	**69200**	<359000	<103000	<200000
Chrysene	**828000**	**462000**	**342000**	**308000**	<200000
Dibenz[a,h]anthracene	<581000	37600	<359000	<103000	<200000
Indeno(1,2,3-c,d)pyrene	**129000**	**128000**	<359000	<103000	<200000

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

Table A3.10 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHST 93-1-1	IHST 93-1-2	IHST 93-1-3	IHST 93-1-4	IHST 93-1-5	IHST 93-2-1	IHST 93-2-2	IHST 93-2-3	IHST 93-2-4
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	USC	USC	USC	USC	USC	USC	USC	USC	USC
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	13.1-17.1	17.1-21.1	21.1-25.1	25.1-29.1	29.1-33.1	11.6-15.6	15.6-19.6	19.6-23.6	23.6-27.6
Latitude	41.64075	41.64075	41.64075	41.64075	41.64075	41.64233	41.64233	41.64233	41.64233
Longitude	-87.4711	-87.4711	-87.4711	-87.4711	-87.4711	-87.4713	-87.4713	-87.4713	-87.4713
Percent TOC	12.98	10.76	9.25	7.36	8.81	13.92	12.65	9.86	10.75
Percent Moisture	64	52	45	40	49	64	60	51	49
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benz[a]anthracene	**125000**	**125000**	**163000**	**186000**	**213000**	**125000**	**111000**	**117000**	**135000**
Benzo(a)pyrene	**107000**	**82700**	**110000**	**124000**	**97600**	**118000**	**86200**	**75100**	**84700**
Benzo(k)fluoranthene	**77800**	**52000**	**63800**	**76100**	**32900**	**86200**	**55300**	**49700**	**54900**
Chrysene	**151000**	**165000**	**202000**	**230000**	**398000**	**142000**	**138000**	**155000**	**165000**
Dibenz[a,h]anthracene	**13100**	**11200**	**13000**	**16300**	**20400**	**12900**	**11100**	**9130**	**10200**
Indeno(1,2,3-c,d)pyrene	**73200**	**45500**	**65900**	**72000**	**44300**	**82600**	**54500**	**40600**	**47400**
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1242	<1030	<919	<990	<1230	<1130	<941	<1020	<1030	<957
Aroclor 1248	**127000**	**375000**	**509000**	**627000**	**43800**	**110000**	**244000**	**519000**	**594000**
Aroclor 1254	<1030	<919	<990	<1230	<1130	<941	<1020	<1030	<957
Aroclor 1260	<1030	<919	<990	<1230	<1130	<941	<1020	<1030	<957
Total PCBs[1]	**127000**	**375000**	**509000**	**627000**	**43800**	**110000**	**244000**	**519000**	**594000**
Pesticides (µg/kg OC)									
Dieldrin	**131**	**191**	**177**	**166**	**66.1**	**71.3**	**179**	**230**	**136**
Endrin	<33.9	<30.4	<32.6	<40.6	<37.3	<31.0	<33.8	<34.0	<31.6
Heptachlor	<30.1	<27.0	<29.1	<36.1	<33.1	<27.6	<30.0	<30.2	<28.1

Table A3.10 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHST 93-1-1	IHST 93-1-2	IHST 93-1-3	IHST 93-1-4	IHST 93-1-5	IHST 93-2-1	IHST 93-2-2	IHST 93-2-3	IHST 93-2-4
Pesticides (µg/kg OC; cont.)									
Heptachlor epoxide	**61.9**	<27.0	<29.1	**100**	<33.1	**73**	<30.0	<30.2	<28.1
Lindane	**51.8**	<26.7	<28.8	<35.7	<32.8	<27.3	<29.7	<29.9	<27.8
p,p'-DDD	**448**	**939**	**1510**	**2060**	**343**	**322**	**610**	**1320**	**1850**
p,p'-DDE	**358**	**344**	**543**	**487**	**190**	**405**	**403**	**347**	**134**
p,p'-DDT	<31.7	<28.4	<30.7	<38.2	<35.1	<29.2	<31.7	<31.9	<29.7

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.10 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHST 93-2-5	IHST 93-3-1	IHST 93-3-2	IHST 93-3-3	IHST 93-3-4	IHST 93-4-2	IHST 93-4-3	IHST 93-4-4	IHST 93-4-5
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	USC	USC	USC	USC	USC	USC	USC	USC	USC
Sampling Year	1993	1993	1993	1993	1993	1993	1993	1993	1993
Depth (ft)	27.6-29.6	6.9-10.9	10.9-14.9	14.9-18.9	18.9-22.9	0.3-4.3	4.3-8.3	8.3-12.3	12.3-16.3
Latitude	41.64233	41.64323	41.64323	41.64323	41.64323	41.64611	41.64611	41.64611	41.64611
Longitude	-87.4713	-87.4713	-87.4713	-87.4713	-87.4713	-87.4719	-87.4719	-87.4719	-87.4719
Percent TOC	13.44	7.84	14.46	11.94	7.27	12.8	10.94	10.44	6.81
Percent Moisture	55	64	52	47	39	54	40	42	34
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benz[a]anthracene	**91500**	**330000**	**89200**	**157000**	**792000**	**224000**	**723000**	**1480000**	**1710000**
Benzo(a)pyrene	**45400**	**311000**	**56000**	**100000**	**316000**	**135000**	**333000**	**679000**	**687000**
Benzo(k)fluoranthene	**21600**	**235000**	**31100**	**74500**	**71500**	**73400**	**93200**	**114000**	**119000**
Chrysene	**147000**	**358000**	**120000**	**193000**	**1680000**	**361000**	**1420000**	**3100000**	**3600000**
Dibenz[a,h]anthracene	**7440**	**31900**	**6920**	**13400**	**79800**	**22700**	**24700**	**155000**	**167000**
Indeno(1,2,3-c,d)pyrene	**24600**	**221000**	**29700**	**60300**	**103000**	**71900**	**122000**	**196000**	**207000**
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1242	<798	<1730	<764	<899	<1460	<901	<797	<878	<1250
Aroclor 1248	**13500**	**262000**	**350000**	**836000**	**124000**	**332000**	**272000**	<878	<1250
Aroclor 1254	<798	<1730	<764	<899	<1460	<901	<797	<878	<1250
Aroclor 1260	<798	<1730	<764	<899	<1460	<901	<797	<878	<1250
Total PCBs[1]	**13500**	**262000**	**350000**	**836000**	**124000**	**332000**	**272000**	NR	NR
Pesticides (µg/kg OC)									
Dieldrin	**103**	**230**	**177**	**215**	**337**	**194**	**190**	<25.0	<35.7
Endrin	<26.3	<57.3	<25.2	<29.6	<48.0	<29.8	<26.3	<29.0	<41.4
Heptachlor	<23.4	<50.9	<22.4	<26.4	<42.6	<26.5	<23.4	<25.8	<36.9

Table A3.10 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1994; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHST 93-2-5	IHST 93-3-1	IHST 93-3-2	IHST 93-3-3	IHST 93-3-4	IHST 93-4-2	IHST 93-4-3	IHST 93-4-4	IHST 93-4-5
Pesticides (µg/kg OC; cont.)									
Heptachlor epoxide	<23.4	<50.9	<22.4	<26.4	**168**	<26.5	<23.4	<25.8	<36.9
Lindane	<23.2	<50.4	<22.2	<26.1	<42.2	<26.2	<23.1	<25.5	<36.4
p,p'-DDD	**204**	**726**	**866**	**2650**	**618**	**1060**	**1110**	**486**	**650**
p,p'-DDE	**378**	**660**	**243**	**305**	<42.0	**257**	**230**	<25.4	<36.3
p,p'-DDT	<24.7	<53.7	<23.7	<27.9	<45.1	<28.0	<24.7	<27.2	<38.9

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; USC = United States Canal.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.11 Sediment chemistry data used to assess injury to human uses of fishery resources (Gillespie et al. 1998; USDOI 1994; bolded values indicate an exceedance of bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**ML2**	**WL4**	**WL5**
Geographic Area	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL
Sampling Year	1995	1995	1995
Depth (ft)	0.66-0.98	0.66-0.98	0.66-0.98
Latitude	41.61527	41.6133	41.61176
Longitude	-87.2731	-87.2889	-87.2931
Percent TOC	0.1	5.1	34.1
Percent Moisture	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)			
Benz[a]anthracene	<700000	<13700	**1530000**
Benzo(a)pyrene	<700000	<13700	**1300000**
Benzo(k)fluoranthene	<700000	**19600**	**604000**
Chrysene	<700000	<13700	**1330000**
Indeno(1,2,3-c,d)pyrene	<700000	<13700	**648000**

OC = organic carbon; TOC = total organic carbon; NR = not reported; GCRL = Grand Calumet River Lagoons.

Table A3.12 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1996; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	001	002	003	004	005	006
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1996	1996	1996	1996	1996	1996
Depth (ft)	0-2	0-3	0-1	2-3	0-2	0-4
Latitude	41.61588	41.61546	41.61589	41.61329	41.61358	41.61221
Longitude	-87.264	-87.2725	-87.2789	-87.2811	-87.2863	-87.2924
Percent TOC	6.65	10.4	9.11	8.87	10.8	38.1
Percent Moisture	79	80	75	77	74	87
Polycyclic Aromatic Hydrocarbons (µg/kg OC)						
Benz[a]anthracene	<14300	<9620	<8780	<9810	<7130	**13100000**
Benzo(a)pyrene	<14300	<9620	<8780	<9810	<7130	**1230000**
Benzo(k)fluoranthene	<14300	<9620	<8780	<9810	<7130	**1000000**
Chrysene	<14300	<9620	<8780	<9810	<7130	**14400000**
Dibenz[a,h]anthracene	<14300	<9620	<8780	<9810	<7130	<814000
Indeno(1,2,3-c,d)pyrene	<14300	<9620	<8780	<9810	<7130	<814000
Polychlorinated Biphenyls (µg/kg OC)						
Aroclor 1016	<1430	<962	<878	<981	<713	<394
Aroclor 1242	<1430	<962	<878	<981	<713	<394
Aroclor 1248	<1430	<962	<878	<981	<713	<394
Aroclor 1254	<1430	<962	<878	<981	<713	<394
Aroclor 1260	<1430	<962	<878	<981	<713	<394
Pesticides (µg/kg OC)						
Dieldrin	<143	<96.2	<87.8	<98.1	<71.3	<39.4
Endrin	<143	<96.2	<87.8	<98.1	<71.3	<39.4
Heptachlor	<72.2	<48.1	<43.9	<49.6	<36.1	<20.2

Table A3.12 Sediment chemistry data used to assess injury to human uses of fishery resources (USACE 1996; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	001	002	003	004	005	006
Pesticides (µg/kg OC; cont.)						
Heptachlor epoxide	<72.2	<48.1	<43.9	<49.6	<36.1	<20.2
Lindane	<72.2	<48.1	<43.9	<49.6	<36.1	<20.2
p,p'-DDD	<436	<288	<263	<293	<213	<121
p,p'-DDE	<143	<96.2	<87.8	<98.1	<71.3	<39.4
p,p'-DDT	<436	<288	<263	<293	<213	<121

OC = organic carbon; TOC = total organic carbon; GCRL = Grand Calumet River Lagoons.

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG82S01	97CG82S02	97CG82S03	97CG82D03	97CG82S04	97CG82S05	97CG82S06	97CG82D06	97CG82S07	97CG82S08
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6124	41.6131	41.613	41.613	41.613	41.6136	41.6136	41.6136	41.6136	41.6142
Longitude	-87.3821	-87.3834	-87.3825	-87.3825	-87.3816	-87.3839	-87.383	-87.383	-87.3821	-87.3834
Percent TOC	1	1	1	1	1	1	1	1	1	1
Percent Moisture	29.59	77.585	59.31	27.08	21.715	88.445	31.16	30.315	19.995	46.075
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<74000	<230000	<130000	<84000	<76000	<370000	<75000	<82000	<78000	<90000
Benzo(a)pyrene	<74000	<230000	<130000	<84000	<76000	<370000	<75000	<82000	<78000	**13000**
Chrysene	<74000	**24000**	<130000	<84000	<76000	<370000	<75000	<82000	<78000	**9600**
Dibenz[a,h]anthracene	<74000	<230000	<130000	<84000	<76000	<370000	<75000	<82000	<78000	**9400**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Aroclor 1242	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Aroclor 1248	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Aroclor 1254	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Aroclor 1260	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<500	<1300	<700	<500	<500	<2400	<400	<400	<400	<500

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG82S01	97CG82S02	97CG82S03	97CG82D03	97CG82S04	97CG82S05	97CG82S06	97CG82D06	97CG82S07	97CG82S08
Pesticides (µg/kg OC; cont.)										
Endrin	<500	<1300	<700	<500	<500	<2400	<400	<400	<400	<500
Heptachlor	<300	<600	<400	<300	<300	<1200	<200	<200	<66200	<300
Heptachlor epoxide	<300	<600	<400	<300	<300	<1200	<200	<200	<200	<300
Lindane	<300	<600	<400	<300	<300	<1200	<200	<200	<200	<300
p,p'-DDD	<500	<1300	<700	<500	<500	<2400	<400	<400	<400	<500
p,p'-DDE	<500	<1300	<700	<500	<500	<2400	<400	<400	<400	<500
p,p'-DDT	<500	<1300	<700	<500	<500	<2400	<400	<400	<400	<500

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG82S09	97CG82S10	97CG82S11	97CG82S12	97CG82S13	97CG82S14	97CG82S15	97CG82D15	97CG82S16	97CG82S17
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6142	41.6142	41.6148	41.6156	41.6156	41.6156	41.6165	41.6165	41.6165	41.6165
Longitude	-87.3825	-87.3816	-87.3839	-87.3838	-87.3826	-87.3815	-87.3838	-87.3838	-87.3826	-87.3815
Percent TOC	1	1	1	1	1	1	1	1.3	1.1	1.2
Percent Moisture	20.81	19.29	26.195	23.31	50.705	59.49	54.59	52.78	45.28	63.825
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<88000	<8000	<72000	<94000	**18000**	**28000**	**11000**	<92300	**13600**	**37500**
Benzo(a)pyrene	<88000	<88000	<72000	<94000	**21000**	**30000**	**12000**	<92300	**14500**	**40800**
Chrysene	<88000	<88000	<72000	<94000	**22000**	**36000**	**12000**	<92300	**18200**	**47500**
Dibenz[a,h]anthracene	<88000	<88000	<72000	<94000	<100000	<110000	<100000	<92300	<86400	<125000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	NR	NR	NR	NR	NR	<13000	NR	NR	NR	NR
Aroclor 1242	NR	NR	NR	NR	NR	<13000	NR	NR	NR	NR
Aroclor 1248	NR	NR	NR	NR	NR	<13000	NR	NR	NR	NR
Aroclor 1254	NR	NR	NR	NR	NR	<13000	NR	NR	NR	NR
Aroclor 1260	NR	NR	NR	NR	NR	<13000	NR	NR	NR	NR
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<400	<400	<400	<500	<500	<700	<500	<538	<455	<667

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG82S09	97CG82S10	97CG82S11	97CG82S12	97CG82S13	97CG82S14	97CG82S15	97CG82D15	97CG82S16	97CG82S17
Pesticides (µg/kg OC; cont.)										
Endrin	<400	<400	<400	<500	<500	<700	<500	<538	<455	<667
Heptachlor	<200	<200	<200	<300	<300	<400	<300	<308	<273	<333
Heptachlor epoxide	<200	<200	<200	<300	<300	<400	<300	<308	<273	<333
Lindane	<200	<200	<200	<300	<300	<400	<300	<308	<273	<333
p,p'-DDD	<400	<400	<400	<500	<500	<700	<500	<538	<455	<667
p,p'-DDE	<400	<400	<400	<500	<500	<700	<500	<538	<455	<667
p,p'-DDT	<400	<400	<400	<500	<2500	<700	<500	<538	<455	<667

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG82S18	97CG82S19	97CG82S20	97CG82S21	97CG82D21	97CG84S01	97CG84S02	97CG84S03	97CG84D03	97CG84S04
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6174	41.6174	41.6183	41.6183	41.6183	41.6078	41.6078	41.6078	41.6078	41.6081
Longitude	-87.3838	-87.3826	-87.3838	-87.3826	-87.3826	-87.3827	-87.3823	-87.3819	-87.3819	-87.3831
Percent TOC	1.2	1.5	1.7	1.2	1	1	1	1	1	1
Percent Moisture	37.41	42.915	33.185	57.81	63.99	21.5	22.615	61.915	38.48	22.08
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**542000**	**8000**	**141000**	**24200**	**27000**	<87000	<76000	**63000**	**67000**	<82000
Benzo(a)pyrene	**575000**	**9330**	**147000**	**25800**	**32000**	<87000	<76000	**100000**	**100000**	<82000
Chrysene	**575000**	**10000**	**165000**	**30000**	**37000**	<87000	<76000	**73000**	**69000**	<82000
Dibenz[a,h]anthracene	**83300**	<65300	**21800**	<100000	<120000	<87000	<76000	<130000	<90000	<82000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	NR	NR	NR	NR	NR	NR	NR	<200000	<100000	NR
Aroclor 1242	NR	NR	NR	NR	NR	NR	NR	<200000	<100000	NR
Aroclor 1248	NR	NR	NR	NR	NR	NR	NR	**2850000**	**690000**	NR
Aroclor 1254	NR	NR	NR	NR	NR	NR	NR	<13000	<10000	NR
Aroclor 1260	NR	NR	NR	NR	NR	NR	NR	<13000	<10000	NR
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	**2850000**	**690000**	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<417	<400	<235	<583	<800	<400	<500	<5000	<4000	<500

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG82S18	97CG82S19	97CG82S20	97CG82S21	97CG82D21	97CG84S01	97CG84S02	97CG84S03	97CG84D03	97CG84S04
Pesticides (µg/kg OC; cont.)										
Endrin	<417	<400	<235	<583	<800	<400	<500	<5000	<4000	<500
Heptachlor	<250	<200	<118	<333	<400	<200	<300	<3000	<2000	<300
Heptachlor epoxide	<250	<200	<118	<333	<400	<200	<300	<3000	<2000	<300
Lindane	<250	<200	<118	<333	<400	<200	<300	<3000	<2000	<300
p,p'-DDD	<417	<400	<235	<583	<800	<400	<500	<5000	<4000	<500
p,p'-DDE	<417	<400	<235	<583	<800	<400	<500	<5000	<4000	<500
p,p'-DDT	<417	<400	<235	<583	<800	<400	<500	<5000	<4000	<500

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG84S05**	**97CG84S06**	**97CG84S07**	**97CG84S08**	**97CG84S09**	**97CG84D09**	**97CG84S10**	**97CG84S11**	**97CG84S12**	**97CG84S13**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6081	41.6081	41.6081	41.6084	41.6084	41.6084	41.6084	41.6084	41.6084	41.6087
Longitude	-87.3827	-87.3823	-87.3819	-87.3835	-87.3831	-87.3831	-87.3827	-87.3823	-87.3819	-87.384
Percent TOC	1	1	1	1	1	1	1.3	1	1	1
Percent Moisture	80.12	86.88	83.31	44.305	84.58	85.58	74.075	76.785	24.885	23.81
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**240000**	**230000**	**240000**	**33000**	**520000**	**160000**	**154000**	**90000**	<81000	<74000
Benzo(a)pyrene	**370000**	**330000**	**370000**	**55000**	**460000**	**240000**	**162000**	**110000**	<81000	<74000
Chrysene	**290000**	**300000**	**310000**	**37000**	**580000**	**200000**	**192000**	**120000**	<81000	<74000
Dibenz[a,h]anthracene	<550000	<720000	<550000	<80000	<650000	<350000	<277000	<180000	<81000	<74000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<30000	<40000	<40000	<10000	<40000	NR	<12300	<20000	<10000	NR
Aroclor 1242	<30000	<40000	<40000	<10000	<40000	NR	<12300	<20000	<10000	NR
Aroclor 1248	**130000**	**290000**	**230000**	**14000**	**170000**	NR	**61500**	**100000**	<10000	NR
Aroclor 1254	<30000	<40000	<40000	<10000	<40000	NR	<12300	<20000	<10000	NR
Aroclor 1260	<30000	<40000	<40000	<10000	<40000	NR	<12300	<20000	<10000	NR
Total PCBs[1]	**130000**	**290000**	**230000**	**14000**	**170000**	NR	**61500**	**100000**	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<4000	<16000	<16000	<5000	<16000	<16000	<6150	<10000	<5000	<400

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG84S05	97CG84S06	97CG84S07	97CG84S08	97CG84S09	97CG84D09	97CG84S10	97CG84S11	97CG84S12	97CG84S13
Pesticides (µg/kg OC; cont.)										
Endrin	<4000	<16000	<16000	<5000	<16000	<16000	<6150	<10000	<5000	<400
Heptachlor	<2000	<8000	<8000	<3000	<8000	<8000	<3080	<5000	<3000	<200
Heptachlor epoxide	<2000	<8000	<8000	<3000	<8000	<8000	<3080	<5000	<3000	<200
Lindane	<2000	<8000	<8000	<3000	<8000	<8000	<3080	<5000	<3000	<200
p,p'-DDD	<4000	<16000	<16000	<5000	<16000	<16000	<6150	<10000	<5000	<400
p,p'-DDE	<4000	<16000	<16000	<5000	<8000	<16000	<6150	<10000	<5000	<400
p,p'-DDT	<4000	<16000	<16000	<5000	<16000	<16000	<6150	<10000	<5000	<400

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**97CG84S14**	**97CG84S15**	**97CG84S16**	**97CG84S17**	**97CG84S18**	**97CG84S19**	**98CG50S06** **South Bonji #2**	**98CG50S07** **South Bonji #5**	**98CG50S08** **North Bonji #6**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II
Sampling Year	1997	1997	1997	1997	1997	1997	1998	1998	1998
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6087	41.6087	41.6087	41.6087	41.6087	41.609	41.6131	41.6136	41.6165
Longitude	-87.3835	-87.3831	-87.3827	-87.3823	-87.3819	-87.3827	-87.3834	-87.3839	-87.3815
Percent TOC	1	1	1	1	1	1	0.04	0.86	1.34
Percent Moisture	72.2	83.12	68.705	26.695	37.89	27.115	75.2406	81.5641	52.40355
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benz[a]anthracene	**140000**	**240000**	**32000**	**13000**	**21000**	**14000**	<5000000	**52300**	**56000**
Benzo(a)pyrene	**190000**	**330000**	**50000**	**20000**	**29000**	**19000**	<5000000	**58100**	**44000**
Chrysene	**140000**	**250000**	**42000**	**17000**	**32000**	**22000**	<5000000	**76700**	**69400**
Dibenz[a,h]anthracene	<180000	**46000**	<160000	<86000	<93000	<75000	<5000000	<209000	<82100
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1016	<20000	<30000	<20000	NR	NR	NR	<350000	NR	<5220
Aroclor 1242	<20000	<30000	<20000	NR	NR	NR	<350000	NR	<5220
Aroclor 1248	**130000**	**230000**	**90000**	NR	NR	NR	<350000	NR	<5220
Aroclor 1254	<20000	<30000	<20000	NR	NR	NR	<350000	NR	<5220
Aroclor 1260	<20000	<30000	<20000	NR	NR	NR	<350000	NR	<5220
Total PCBs[1]	**130000**	**230000**	**90000**	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)									
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<10000	<16000	<8000	<5000	<4000	<4000	<17500	<1160	<299

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station / **Sample**	**97CG84S14**	**97CG84S15**	**97CG84S16**	**97CG84S17**	**97CG84S18**	**97CG84S19**	**98CG50S06** **South Bonji #2**	**98CG50S07** **South Bonji #5**	**98CG50S08** **North Bonji #6**
Pesticides (µg/kg OC; cont.)									
Endrin	<10000	<16000	<8000	<5000	<4000	<4000	<17500	<1160	<299
Heptachlor	<5000	<8000	<4000	<3000	<2000	<2000	<10000	<581	<149
Heptachlor epoxide	<5000	<8000	<4000	<3000	<2000	<2000	<10000	<581	<149
Lindane	<5000	<8000	<4000	<3000	<2000	<2000	<10000	<581	<149
p,p'-DDD	<10000	<16000	<8000	<5000	<4000	<4000	<17500	<1160	<299
p,p'-DDE	<5000	<3000	<8000	<5000	<2000	<40000	**17500**	**814**	**522**
p,p'-DDT	<10000	<16000	<8000	<5000	<4000	<4000	<17500	<1160	<299

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**98CG50S09** **North Bonji #10**	**98CG50S10** **Georgia Pacific #5**	**98CG50S11** **Georgia Pacific #7**	**98CG50S12** **Georgia Pacific #9**	**98CG50S13** **Georgia Pacific #14**	**97CG80S01**	**97CG80S02**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCRL	GCRL
Reach	EBGCR II	EBGCR II	EBGCR II	EBGCR II	EBGCR II	GCRL	GCRL
Sampling Year	1998	1998	1998	1998	1998	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6183	41.6081	41.6081	41.6084	41.6087	41.6115	41.6115
Longitude	-87.3826	-87.3827	-87.3819	-87.3831	-87.3835	-87.2947	-87.294
Percent TOC	0.68	0.76	0.9	0.87	0.94	24.2	17.3
Percent Moisture	55.80045	75.02225	83.335	83.0532	75.9243	50.195	64.695
Polycyclic Aromatic Hydrocarbons (µg/kg OC)							
Benz[a]anthracene	**75000**	**250000**	**378000**	**425000**	<223000	**45100000**	**555000**
Benzo(a)pyrene	**72100**	**316000**	**511000**	**425000**	**277000**	**16500000**	**191000**
Chrysene	**85300**	**303000**	**422000**	**218000**	<245000	**550000**	**694000**
Dibenz[a,h]anthracene	<162000	**57900**	**111000**	<644000	<447000	**1070000**	**17300**
Polychlorinated Biphenyls (µg/kg OC)							
Aroclor 1016	<14700	<19700	<22200	<23000	<21300	<2070	<867
Aroclor 1242	<14700	**526000**	<22200	<23000	<21300	<2070	<867
Aroclor 1248	<14700	<19700	**311000**	**276000**	**270000**	<2070	<867
Aroclor 1254	<14700	<19700	<22200	<23000	<21300	<2070	<867
Aroclor 1260	<14700	<19700	<22200	<23000	<21300	<2070	<867
Total PCBs[1]	NR	**526000**	**311000**	**276000**	**270000**	NR	NR
Pesticides (µg/kg OC)							
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	<921	<1110	<1150	<851	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	98CG50S09 North Bonji #10	98CG50S10 Georgia Pacific #5	98CG50S11 Georgia Pacific #7	98CG50S12 Georgia Pacific #9	98CG50S13 Georgia Pacific #14	97CG80S01	97CG80S02
Pesticides (µg/kg OC; cont.)							
Endrin	NR	<921	<1110	<1150	<851	NR	NR
Heptachlor	NR	<526	<556	<575	<426	NR	NR
Heptachlor epoxide	NR	<526	<556	<575	<426	NR	NR
Lindane	NR	<526	<556	<575	<426	NR	NR
p,p'-DDD	NR	<921	<1110	<1150	<851	NR	NR
p,p'-DDE	NR	**5000**	<1110	**5060**	**3300**	NR	NR
p,p'-DDT	NR	<921	<1110	<1150	<851	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S03	97CG80S04	97CG80S05	97CG80S06	97CG80S07	97CG80D07	97CG80S08	97CG80S09	97CG80S10	97CG80S11
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6119	41.6119	41.6119	41.6123	41.6123	41.6123	41.6127	41.6127	41.6132	41.6132
Longitude	-87.2937	-87.2931	-87.2924	-87.2927	-87.2921	-87.2921	-87.2911	-87.2905	-87.2895	-87.2888
Percent TOC	2.2	2	28.9	1	2	1	4.9	2.6	1.8	1.5
Percent Moisture	86.725	83.585	31.34	80.88	81.6	77.585	70.295	84.50999	81.675	81.305
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**3500000**	**600000**	NR	**870000**	**4300000**	**10000000**	**306000**	**185000**	**72200**	**180000**
Benzo(a)pyrene	**4140000**	**600000**	NR	**900000**	**2300000**	**5700000**	**327000**	**204000**	**83300**	**193000**
Chrysene	**3640000**	**700000**	NR	**990000**	**3400000**	**8000000**	**347000**	**204000**	**117000**	**260000**
Dibenz[a,h]anthracene	**164000**	<1850000	NR	<3300000	<700000	**340000**	<204000	**33500**	<339000	**30700**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<18200	<20000	<16300	<40000	<15000	<30000	<6120	<15400	<16700	<20000
Aroclor 1242	**59100**	**20000**	<16300	<40000	<15000	<30000	<6120	**11500**	<16700	<20000
Aroclor 1248	<18200	<20000	<16300	<40000	<15000	<30000	<6120	<15400	<16700	<20000
Aroclor 1254	<18200	<20000	<16300	<40000	<15000	<30000	<6120	<15400	<16700	<20000
Aroclor 1260	**40900**	**5000**	<16300	<40000	<15000	<30000	<6120	**19200**	<16700	<20000
Total PCBs[1]	**100000**	**25000**	NR	NR	NR	NR	NR	**30800**	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S03	97CG80S04	97CG80S05	97CG80S06	97CG80S07	97CG80D07	97CG80S08	97CG80S09	97CG80S10	97CG80S11
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG80S12**	**97CG80S13**	**97CG80S14**	**97CG80S15**	**97CG80S16**	**97CG80S17**	**97CG80S18**	**97CG80S19**	**97CG80S20**	**97CG80S21**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6132	41.6132	41.6132	41.6132	41.6132	41.6132	41.6132	41.6136	41.6136	41.6136
Longitude	-87.2882	-87.2875	-87.281	-87.2803	-87.2797	-87.279	-87.2784	-87.2885	-87.2879	-87.2872
Percent TOC	1.1	1	1	1	1	1	1	1	1	2.4
Percent Moisture	87.08	88.18	88.49001	63.125	90.3	61.125	78.31	75.165	42.6	83.595
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**76400**	**400000**	**350000**	**20000**	<2300000	**26000**	**65000**	**930000**	**27000**	**300000**
Benzo(a)pyrene	**78200**	**440000**	**430000**	**20000**	<2300000	**34000**	**64000**	**1400000**	**19000**	**387000**
Chrysene	**100000**	**590000**	**460000**	**25000**	<2300000	**33000**	**79000**	**1800000**	**24000**	**358000**
Dibenz[a,h]anthracene	<318000	**84000**	**163000**	<140000	<2300000	<130000	<490000	**200000**	<110000	**58300**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<36400	<40000	<40000	<15000	<50000	<20000	<30000	<20000	<10000	<20800
Aroclor 1242	<36400	<40000	<40000	<15000	<50000	<20000	<30000	<20000	<10000	<20800
Aroclor 1248	<36400	<40000	<40000	<15000	<50000	<20000	<30000	<20000	<10000	<20800
Aroclor 1254	<36400	<40000	<40000	<15000	<50000	<20000	<30000	<20000	<10000	<20800
Aroclor 1260	<36400	<40000	<40000	<15000	<50000	<20000	<30000	<20000	<10000	<20800
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG80S12**	**97CG80S13**	**97CG80S14**	**97CG80S15**	**97CG80S16**	**97CG80S17**	**97CG80S18**	**97CG80S19**	**97CG80S20**	**97CG80S21**
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S22	97CG80S23	97CG80S24	97CG80S25	97CG80D25	97CG80S26	97CG80S27	97CG80S28	97CG80S29	97CG80S30
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6136	41.6136	41.6136	41.6136	41.6136	41.6136	41.6136	41.6136	41.6136	41.6136
Longitude	-87.2865	-87.2859	-87.2852	-87.2846	-87.2846	-87.2839	-87.2833	-87.2826	-87.282	-87.2813
Percent TOC	2.1	1	1	1	1	1	1	1.6	1	1
Percent Moisture	76.58	80.075	70.73	84.11	96.86	88.67	88.415	87.99001	24.7	47.5
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**25700**	**43000**	NR	**140000**	**390000**	**480000**	**69000**	**1500000**	**27000**	<100000
Benzo(a)pyrene	**29500**	**28000**	NR	**150000**	**440000**	**670000**	**92000**	**1060000**	**35000**	<100000
Chrysene	**40000**	**63000**	NR	**190000**	**500000**	**560000**	**96000**	**1690000**	**34000**	**13000**
Dibenz[a,h]anthracene	<95200	<250000	NR	<680000	<1700000	**95000**	<350000	**331000**	<64000	<100000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<9520	<30000	<20000	<40000	<180000	<30000	<40000	<18700	<10000	<10000
Aroclor 1242	<9520	<30000	<20000	<40000	<180000	**154000**	<40000	**37500**	<10000	<10000
Aroclor 1248	<9520	<30000	<20000	<40000	<180000	<30000	<40000	<18700	<10000	<10000
Aroclor 1254	<9520	<30000	<20000	<40000	<180000	**30000**	<40000	<18700	<10000	<10000
Aroclor 1260	<9520	<30000	<20000	<40000	<180000	<30000	<40000	<18700	<10000	<10000
Total PCBs[1]	NR	NR	NR	NR	NR	**184000**	NR	**37500**	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S22	97CG80S23	97CG80S24	97CG80S25	97CG80D25	97CG80S26	97CG80S27	97CG80S28	97CG80S29	97CG80S30
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S31	97CG80S32	97CG80S33	97CG80S34	97CG80S35	97CG80S36	97CG80S37	97CG80S38	97CG80S39	97CG80S40
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6136	41.6136	41.6136	41.6136	41.614	41.614	41.614	41.614	41.614	41.614
Longitude	-87.2807	-87.2787	-87.278	-87.2774	-87.2856	-87.2849	-87.2843	-87.2836	-87.2784	-87.2777
Percent TOC	1	1	1	1	1	1	1	1	1	1
Percent Moisture	55.8	76.595	52.725	78.88	60.095	60.405	78.185	22.28	36.92	57
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**18000**	<190000	**14000**	<170000	**9500**	**16000**	<480000	**10000**	<64000	**24000**
Benzo(a)pyrene	**18000**	**27000**	**16000**	<170000	**12000**	**20000**	**52000**	**13000**	<64000	**31000**
Chrysene	**26000**	**22000**	**21000**	<170000	**13000**	**19000**	**61000**	**12000**	**7800**	**42000**
Dibenz[a,h]anthracene	<120000	<190000	<130000	<170000	<79000	<150000	<480000	<87000	<64000	<240000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<20000	NR	<20000	<10000	<16000	<25000	<10000	<10000	<10000
Aroclor 1242	<10000	<20000	NR	<20000	<10000	<16000	<25000	<10000	<10000	<10000
Aroclor 1248	<10000	<20000	NR	<20000	<10000	<16000	<25000	<10000	<10000	<10000
Aroclor 1254	<10000	<20000	NR	<20000	<10000	<16000	<25000	<10000	<10000	<10000
Aroclor 1260	<10000	<20000	NR	<20000	<10000	<16000	<25000	<10000	<10000	<10000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S31	97CG80S32	97CG80S33	97CG80S34	97CG80S35	97CG80S36	97CG80S37	97CG80S38	97CG80S39	97CG80S40
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S41	97CG80S42	97CG80S43	97CG80S44	97CG80S45	97CG80S46	97CG80S47	97CG80S48	97CG80S49	97CG80S50
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.614	41.6166	41.6166	41.617	41.617	41.6174	41.6174	41.6174	41.6174	41.6174
Longitude	-87.2771	-87.2626	-87.262	-87.2623	-87.2617	-87.262	-87.2614	-87.2609	-87.2603	-87.2597
Percent TOC	1	1	1	1	1.1	1	1.4	1.8	1.7	1
Percent Moisture	46.775	76.9	64.8	43.5	75.98	64.1	30.4	41.1	31.385	20.8
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**12000**	**63000**	<270000	<89000	**218000**	**13000**	**7140**	<61100	**11800**	**1400000**
Benzo(a)pyrene	**14000**	**72000**	<270000	<89000	**282000**	**15000**	**7860**	<61100	**12400**	**1300000**
Chrysene	**13000**	**97000**	<270000	<89000	**345000**	**18000**	**10700**	<61100	**15300**	**1500000**
Dibenz[a,h]anthracene	<85000	<490000	<270000	<89000	**41800**	<130000	<62900	<61100	<46500	**180000**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<20000	<10000	<10000	<12700	<10000	<3570	<2780	<3530	<5000
Aroclor 1242	<10000	<20000	<10000	<10000	<12700	<10000	<3570	<2780	<3530	<5000
Aroclor 1248	<10000	<20000	<10000	<10000	<12700	<10000	<3570	<2780	<3530	<5000
Aroclor 1254	<10000	<20000	<10000	<10000	<12700	<10000	<3570	<2780	<3530	<5000
Aroclor 1260	<10000	<20000	<10000	<10000	<12700	<10000	<3570	<2780	<3530	<5000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	**2400**	NR	NR	**1270**	NR	NR	**222**	NR	**5100**
Dieldrin	NR	<1000	<500	<400	<636	<200	<214	**55.6**	<118	<300

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S41	97CG80S42	97CG80S43	97CG80S44	97CG80S45	97CG80S46	97CG80S47	97CG80S48	97CG80S49	97CG80S50
Pesticides (µg/kg OC; cont.)										
Endrin	NR	<1000	<500	<400	**636**	200	<214	<167	<118	<300
Heptachlor	NR	<500	<300	<200	<273	<200	<71.4	<55.6	<58.8	<100
Heptachlor epoxide	NR	<500	<300	<200	<273	<200	<71.4	<55.6	<58.8	<100
Lindane	NR	<500	<300	<200	<273	<200	<71.4	<55.6	<58.8	<100
p,p'-DDD	NR	<1000	<500	<200	<636	<400	<214	**389**	**5470**	**167000**
p,p'-DDE	NR	**79000**	**300**	<200	**53300**	**700**	**1000**	**444**	**4060**	**127000**
p,p'-DDT	NR	**18000**	<500	<400	**13100**	**400**	<214	**4560**	**882**	<300

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG80S51**	**97CG80S52**	**97CG80D52**	**97CG80S53**	**97CG80S54**	**97CG80S55**	**97CG80S56**	**97CG80S57**	**97CG80S58**	**97CG80S59**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6145	41.6145	41.6145	41.6145	41.6145	41.6149	41.6149	41.6149	41.6149	41.6149
Longitude	-87.2758	-87.2753	-87.2753	-87.2747	-87.2741	-87.2744	-87.2738	-87.2732	-87.2726	-87.2721
Percent TOC	1	1	1	1	1	1	1	1	1	1
Percent Moisture	37.62	71.985	64.98	64.50999	25.61	41.28	72.22	80.72	43.61	43.61
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<89000	**21000**	<650000	<150000	<81000	<86000	<180000	<310000	<180000	<65000
Benzo(a)pyrene	<89000	**23000**	<650000	<150000	<81000	<86000	<180000	<310000	<180000	<65000
Chrysene	<89000	**34000**	<650000	<150000	<81000	<86000	<180000	<310000	<180000	<65000
Dibenz[a,h]anthracene	<89000	<190000	<650000	<150000	<81000	<86000	<180000	<310000	<180000	<65000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<20000	<13000	<15000	<10000	<10000	<20000	<30000	<16000	<10000
Aroclor 1242	<10000	<20000	<13000	<15000	<10000	<10000	<20000	<30000	<16000	<10000
Aroclor 1248	<10000	<20000	<13000	<15000	<10000	<10000	<20000	<30000	<16000	<10000
Aroclor 1254	<10000	<20000	<13000	<15000	<10000	<10000	<20000	<30000	<16000	<10000
Aroclor 1260	<10000	<20000	<13000	<15000	<10000	<10000	<20000	<30000	<16000	<10000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S51	97CG80S52	97CG80D52	97CG80S53	97CG80S54	97CG80S55	97CG80S56	97CG80S57	97CG80S58	97CG80S59
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S60	97CG80S61	97CG80S62	97CG80S63	97CG80S64	97CG80S65	97CG80S66	97CG80S67	97CG80S68	97CG80D68
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6149	41.6152	41.6153	41.6153	41.6153	41.6153	41.6153	41.6153	41.6153	41.6153
Longitude	-87.2715	-87.2741	-87.2735	-87.2729	-87.2723	-87.2718	-87.2712	-87.2706	-87.27	-87.27
Percent TOC	1	1	1.1	1	1	1.1	1.1	1.2	1	1
Percent Moisture	18.095	25.605	68.295	72.225	79.72	78.16	80.485	69.59	82.665	82.875
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<72000	<77000	<145000	<200000	<250000	NR	NR	<117000	**98000**	**34000**
Benzo(a)pyrene	<72000	<77000	<145000	<200000	<250000	NR	NR	<117000	**130000**	**34000**
Chrysene	<72000	<77000	<145000	<200000	<250000	NR	NR	<117000	**140000**	**44000**
Dibenz[a,h]anthracene	<72000	<77000	<145000	<200000	<250000	NR	NR	<117000	**22000**	<330000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<10000	<18200	<16000	<26000	<45500	<23600	<11700	<20000	<30000
Aroclor 1242	<10000	<10000	<18200	<16000	<26000	<45500	<23600	<11700	<20000	<30000
Aroclor 1248	<10000	<10000	<18200	<16000	<26000	<45500	<23600	<11700	<20000	<30000
Aroclor 1254	<10000	<10000	<18200	<16000	<26000	<45500	<23600	<11700	**164000**	<30000
Aroclor 1260	<10000	<10000	<18200	<16000	<26000	<45500	<23600	<11700	<20000	<30000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	**164000**	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S60	97CG80S61	97CG80S62	97CG80S63	97CG80S64	97CG80S65	97CG80S66	97CG80S67	97CG80S68	97CG80D68
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG80S69**	**97CG80S70**	**97CG80S71**	**97CG80S72**	**97CG80S73**	**97CG80S74**	**97CG80S75**	**97CG80S76**	**97CG80S77**	**97CG80S78**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6153	41.6153	41.6156	41.6156	41.6156	41.6155	41.6156	41.6156	41.6156	41.616
Longitude	-87.2694	-87.2689	-87.2732	-87.2726	-87.2721	-87.2715	-87.2709	-87.2703	-87.2697	-87.2729
Percent TOC	1	1	1	1.9	1	1.2	1.2	1	1	1
Percent Moisture	52.1	30.785	74.79	81.9	77.48	69.6	61.72	59.8	48.98	45.275
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<200000	**140000**	<230000	<311000	<240000	<150000	<117000	<140000	<99000	<190000
Benzo(a)pyrene	<200000	**160000**	<230000	<311000	<240000	<150000	<117000	**17000**	<99000	<190000
Chrysene	<200000	**210000**	<230000	<311000	<240000	<150000	<117000	**22000**	<99000	<190000
Dibenz[a,h]anthracene	<200000	**28000**	<230000	<311000	<240000	<150000	<117000	<140000	<99000	<190000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<8000	<5000	<25000	<10500	<20000	<16700	<12500	<13000	<10000	<10000
Aroclor 1242	<8000	<5000	<25000	<10500	<20000	<16700	<12500	<13000	<10000	<10000
Aroclor 1248	<8000	<5000	<25000	<10500	<20000	<16700	<12500	<13000	<10000	<10000
Aroclor 1254	<8000	<5000	<25000	<10500	<20000	<16700	<12500	<13000	<10000	<10000
Aroclor 1260	<8000	**13000**	<25000	<10500	<20000	<16700	<12500	<13000	<10000	<10000
Total PCBs[1]	NR	**13000**	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S69	97CG80S70	97CG80S71	97CG80S72	97CG80S73	97CG80S74	97CG80S75	97CG80S76	97CG80S77	97CG80S78
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S79	97CG80S80	97CG80S81	97CG80S82	97CG80S83	97CG80S84	97CG80S85	97CG80S86	97CG80S87	97CG80S88
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.616	41.616	41.616	41.6164	41.6164	41.6164	41.6164	41.6168	41.6168	41.6168
Longitude	-87.2723	-87.2718	-87.2712	-87.2738	-87.2732	-87.2726	-87.2721	-87.2741	-87.2735	-87.2729
Percent TOC	1	1	1	1	1	1	1	1	1	1
Percent Moisture	68.425	65.9	69.985	34.495	26.705	41	24.965	39	18.605	39.18
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<160000	<150000	<170000	**8900**	<70000	**310000**	NR	<93000	NR	**99000**
Benzo(a)pyrene	<160000	<150000	<170000	**12000**	<70000	**390000**	NR	<93000	NR	**120000**
Chrysene	<160000	<150000	<170000	**13000**	<70000	**470000**	NR	<93000	NR	**150000**
Dibenz[a,h]anthracene	<160000	<150000	<170000	<84000	<70000	**51000**	NR	<93000	NR	**15000**
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<20000	<16000	<20000	<10000	<10000	<10000	<10000	<10000	<6000	<10000
Aroclor 1242	<20000	<16000	<20000	<10000	<10000	<10000	<10000	<10000	<6000	<10000
Aroclor 1248	<20000	<16000	<20000	<10000	<10000	<10000	<10000	<10000	<6000	<10000
Aroclor 1254	<20000	<16000	<20000	<10000	<10000	<10000	<10000	<10000	<6000	<10000
Aroclor 1260	<20000	<16000	<20000	<10000	<10000	<10000	<10000	<10000	<6000	<10000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S79	97CG80S80	97CG80S81	97CG80S82	97CG80S83	97CG80S84	97CG80S85	97CG80S86	97CG80S87	97CG80S88
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S89	97CG80S90	97CG80S91	97CG80S92	97CG80S93	97CG80S94	97CG80S95	97CG80S96	97CG80D96	97CG80S97
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6168	41.6168	41.6152	41.6152	41.6152	41.6152	41.6155	41.6155	41.6155	41.6155
Longitude	-87.2724	-87.2718	-87.2682	-87.2677	-87.2671	-87.2665	-87.2674	-87.2668	-87.2668	-87.2662
Percent TOC	1	1	1	1	1.4	1	3.3	1	1	1
Percent Moisture	47.98	29.515	21.51	80.81	75.785	30.92	16.58	77.685	80.99001	82.08
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**7100000**	<82000	**20000**	**180000**	**50000**	<89000	**39400**	<210000	**67000**	**130000**
Benzo(a)pyrene	**6700000**	**12000**	**19000**	**210000**	**47100**	<89000	**26700**	<210000	**73000**	**150000**
Chrysene	**8100000**	**14000**	**24000**	**290000**	**63600**	<89000	**42400**	<210000	**92000**	**200000**
Dibenz[a,h]anthracene	**710000**	<82000	<89000	<620000	<171000	<89000	**3330**	<210000	<250000	<470000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<10000	NR	<30000	<21400	<10000	<1520	<20000	<25000	<30000
Aroclor 1242	<10000	<10000	NR	<30000	<21400	<10000	<1520	<20000	<25000	<30000
Aroclor 1248	<10000	<10000	NR	<30000	<21400	<10000	<1520	<20000	<25000	<30000
Aroclor 1254	<10000	<10000	NR	<30000	<21400	<10000	<1520	<20000	<25000	<30000
Aroclor 1260	<10000	<10000	NR	<30000	<21400	<10000	<1520	<20000	<25000	<30000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	**600**	**1300**	NR	NR	**90.9**	NR	NR	NR
Dieldrin	NR	NR	<400	<1500	<1070	NR	<90.9	<1000	<1300	<700

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S89	97CG80S90	97CG80S91	97CG80S92	97CG80S93	97CG80S94	97CG80S95	97CG80S96	97CG80D96	97CG80S97
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	<400	<1500	<1070	NR	<90.9	<1000	<1300	<1400
Heptachlor	NR	NR	<200	<700	<500	NR	<30.3	<500	<600	<700
Heptachlor epoxide	NR	NR	<200	<700	<500	NR	<30.3	<500	<600	<700
Lindane	NR	NR	<200	<700	<500	NR	<30.3	<500	<600	<700
p,p'-DDD	NR	NR	**2300**	**5700**	**6790**	NR	**212**	<500	**4800**	**7500**
p,p'-DDE	NR	NR	**9000**	**27700**	**21300**	NR	**1360**	**4000**	**38100**	**34600**
p,p'-DDT	NR	NR	**1100**	**2800**	**1640**	NR	**182**	<0	**2900**	**6700**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S98	97CG80S99	97CG81S01	97CG81S02	97CG81S03	97CG81S04	97CG81S05	97CG81S06	97CG81S07	97CG81S08
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6155	41.6155	41.6155	41.6155	41.6155	41.6155	41.6159	41.6159	41.6159	41.6159
Longitude	-87.2657	-87.2651	-87.2645	-87.264	-87.2634	-87.2628	-87.2654	-87.2648	-87.2643	-87.2637
Percent TOC	1	1	1	1	1	1.3	1	1	1	1
Percent Moisture	53.105	20.11	84.795	25.12	76.185	73.205	77.21	78.45	55.3	72.685
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**13000**	<89000	**60000**	<67000	**56000**	**362000**	<200000	NR	**19000**	<170000
Benzo(a)pyrene	**14000**	<89000	**69000**	<67000	**72000**	**415000**	<200000	NR	**24000**	<170000
Chrysene	**16000**	<89000	**80000**	<67000	**73000**	**492000**	<200000	NR	**28000**	**19000**
Dibenz[a,h]anthracene	<110000	<89000	<280000	<67000	<230000	**67700**	<200000	NR	<100000	<170000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	NR	<10000	<30000	<6000	<22000	<15400	NR	<25000	<12000	<20000
Aroclor 1242	NR	<10000	<30000	<6000	<22000	<15400	NR	<25000	<12000	<20000
Aroclor 1248	NR	<10000	<30000	<6000	<22000	<15400	NR	<25000	<12000	<20000
Aroclor 1254	NR	<10000	<30000	<6000	<22000	<15400	NR	<25000	<12000	<20000
Aroclor 1260	NR	<10000	<30000	<6000	<22000	<15400	NR	<25000	<12000	<20000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	**900**	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	<400	<1500	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG80S98	97CG80S99	97CG81S01	97CG81S02	97CG81S03	97CG81S04	97CG81S05	97CG81S06	97CG81S07	97CG81S08
Pesticides (µg/kg OC; cont.)										
Endrin	NR	<400	<1500	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	<200	<700	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	<200	<700	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	<200	<700	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	<400	**8500**	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	<400	**63000**	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	<400	**9400**	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG81S09**	**97CG81D09**	**97CG81S10**	**97CG81S11**	**97CG81S12**	**97CG81S13**	**97CG81S14**	**97CG81S15**	**97CG81S16**	**97CG81S17**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6159	41.6159	41.6159	41.6163	41.6163	41.6163	41.6163	41.6166	41.6166	41.6177
Longitude	-87.2631	-87.2631	-87.2626	-87.264	-87.2634	-87.2629	-87.2623	-87.2637	-87.2631	-87.2617
Percent TOC	1.3	1	1	1	1	1	1	1	1	1
Percent Moisture	72.1	73.9	64.9	59.9	29.8	77.375	71.705	23.605	68.38	79.895
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**53100**	**160000**	**340000**	<140000	<90000	**160000**	<180000	**23000**	<150000	<190000
Benzo(a)pyrene	**69200**	**210000**	**390000**	<140000	<90000	**220000**	<180000	**37000**	**16000**	<190000
Chrysene	**76900**	**220000**	**440000**	<140000	<90000	**240000**	<180000	**31000**	**18000**	<190000
Dibenz[a,h]anthracene	<162000	**35000**	**47000**	<140000	<90000	**34000**	<180000	<72000	<150000	<190000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<15400	<20000	<15000	<14000	<10000	<25000	<20000	<10000	<20000	<30000
Aroclor 1242	<15400	<20000	<15000	<14000	<10000	<25000	<20000	<10000	<20000	<30000
Aroclor 1248	<15400	<20000	<15000	<14000	<10000	<25000	<20000	<10000	<20000	<30000
Aroclor 1254	<15400	<20000	**45000**	<14000	<10000	<25000	<20000	<10000	<20000	<30000
Aroclor 1260	<15400	<20000	<15000	<14000	<10000	<25000	<20000	<10000	<20000	<30000
Total PCBs[1]	NR	NR	**45000**	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG81S09	97CG81D09	97CG81S10	97CG81S11	97CG81S12	97CG81S13	97CG81S14	97CG81S15	97CG81S16	97CG81S17
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**97CG81S18**	**97CG81S19**	**97CG81S20**	**97CG83S01**	**97CG83D01**	**97CG83S02**	**97CG83S03**	**97CG83S04**	**97CG83S05**	**97CG83S06**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6177	41.6177	41.6177	41.6154	41.6154	41.6156	41.6156	41.6156	41.6156	41.6158
Longitude	-87.2612	-87.2606	-87.26	-87.2788	-87.2788	-87.2785	-87.2789	-87.2787	-87.2784	-87.2791
Percent TOC	1	1	1	1.1	1.1	1	1.1	1	1	1
Percent Moisture	27.38	23.295	34.47	50.07	40.01	39.305	64.21	33.01	30.79	52.015
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<75000	<76000	**12000**	**27300**	<76400	**22000**	NR	<77000	<76000	**27000**
Benzo(a)pyrene	<75000	<76000	**14000**	**45500**	<76400	**32000**	NR	**8900**	<76000	**43000**
Chrysene	<75000	<76000	**17000**	**35500**	<76400	**29000**	NR	<77000	<76000	**37000**
Dibenz[a,h]anthracene	<75000	<76000	<76000	<109000	<76400	<110000	NR	<77000	<76000	<130000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<10000	<10000	<9090	<9090	<10000	<18200	<10000	<10000	<13000
Aroclor 1242	<10000	<10000	<10000	<9090	<9090	<10000	<18200	<10000	<10000	<13000
Aroclor 1248	<10000	<10000	<10000	<9090	<9090	<10000	<18200	<10000	<10000	<13000
Aroclor 1254	<10000	<10000	<10000	<9090	<9090	<10000	<18200	<10000	<10000	<13000
Aroclor 1260	<10000	<10000	<10000	<9090	<9090	**30000**	**21800**	<10000	<10000	<13000
Total PCBs[1]	NR	NR	NR	NR	NR	**30000**	**21800**	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG81S18	97CG81S19	97CG81S20	97CG83S01	97CG83D01	97CG83S02	97CG83S03	97CG83S04	97CG83S05	97CG83S06
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG83S07**	**97CG83S08**	**97CG83S09**	**97CG83S10**	**97CG83S11**	**97CG83S12**	**97CG83S13**	**97CG83S14**	**97CG83S15**	**97CG83S16**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6158	41.6158	41.616	41.616	41.616	41.6161	41.6161	41.6161	41.6163	41.6163
Longitude	-87.2788	-87.2785	-87.2792	-87.2789	-87.2787	-87.2793	-87.2791	-87.2788	-87.2794	-87.2792
Percent TOC	1.5	1.4	1	1	1	1	1	1.1	1	1
Percent Moisture	53.19	53.99	31.1	42.425	28.58	32.895	39.455	27	30.62	30.095
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**19300**	**48600**	NR	**13000**	**9100**	**8500**	**20000**	<79100	**17000**	**9200**
Benzo(a)pyrene	**33300**	**70700**	NR	**22000**	**15000**	**13000**	**35000**	**8270**	**28000**	**16000**
Chrysene	**28700**	**59300**	NR	**17000**	**11000**	**12000**	**28000**	<79100	**21000**	**11000**
Dibenz[a,h]anthracene	<73300	<78600	NR	<90000	<81000	<78000	<92000	<79100	<82000	<80000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<6670	<7140	<10000	<10000	<10000	<10000	<10000	<9090	<10000	<10000
Aroclor 1242	<6670	<7140	<10000	<10000	<10000	<10000	<10000	<9090	<10000	<10000
Aroclor 1248	<6670	<7140	<10000	<10000	<10000	<10000	<10000	<9090	<10000	<10000
Aroclor 1254	<6670	<71400	<10000	<10000	<10000	<10000	<10000	<9090	<10000	<10000
Aroclor 1260	<6670	<379000	<10000	**13000**	<10000	<10000	<10000	<9090	<10000	**13000**
Total PCBs[1]	NR	NR	NR	**13000**	NR	NR	NR	NR	NR	**13000**
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG83S07	97CG83S08	97CG83S09	97CG83S10	97CG83S11	97CG83S12	97CG83S13	97CG83S14	97CG83S15	97CG83S16
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG83S17	97CG83S18	97CG83S19	97CG83D19	97CG83S20	97CG85S01	97CG85S02	97CG85S03	97CG85S04	97CG85S05
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6163	41.6163	41.6165	41.6165	41.6165	41.6155	41.6157	41.6157	41.616	41.616
Longitude	-87.2789	-87.2787	-87.2798	-87.2798	-87.2796	-87.2761	-87.2768	-87.2757	-87.2768	-87.2764
Percent TOC	1	1	1	1	1	1	1	1	1	1
Percent Moisture	34.19	27.595	56.21	48.575	24.8	44.525	31	48.695	47.005	34.08
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	**18000**	**15000**	**54000**	**39000**	<86000	**12000**	**8800**	<120000	<100000	**15000**
Benzo(a)pyrene	**31000**	**21000**	**83000**	**58000**	<86000	**17000**	**13000**	<120000	<100000	**23000**
Chrysene	**22000**	**19000**	**75000**	**53000**	<86000	**14000**	**12000**	**14000**	<100000	**35000**
Dibenz[a,h]anthracene	<77000	<71000	**13000**	<100000	<86000	<110000	<86000	<120000	<100000	<86000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<10000	<10000	<10000	<10000	<13000	<10000	<13000	<10000	<10000
Aroclor 1242	<10000	<10000	<10000	<10000	<10000	<13000	<10000	<13000	<10000	<10000
Aroclor 1248	<10000	<10000	<10000	<10000	<10000	<13000	<10000	<13000	<10000	<10000
Aroclor 1254	<10000	<10000	<10000	<10000	<10000	<13000	<10000	<13000	<10000	<10000
Aroclor 1260	<10000	**30000**	**10000**	**10000**	<10000	<13000	<10000	<13000	<10000	<10000
Total PCBs[1]	NR	**30000**	**10000**	**10000**	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG83S17	97CG83S18	97CG83S19	97CG83D19	97CG83S20	97CG85S01	97CG85S02	97CG85S03	97CG85S04	97CG85S05
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	**97CG85S06**	**97CG85D06**	**97CG85S07**	**97CG85S08**	**97CG85S09**	**97CG85S10**	**97CG85D10**	**97CG85S11**	**97CG85S12**	**97CG85S13**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.616	41.616	41.616	41.6163	41.6163	41.6163	41.6163	41.6163	41.6163	41.6165
Longitude	-87.2761	-87.2761	-87.2757	-87.2771	-87.2768	-87.2764	-87.2764	-87.2761	-87.2757	-87.2764
Percent TOC	1	1	1	1	1	1	1	1	1	1
Percent Moisture	43.205	34.315	37.705	40.19	42.65	29.31	31.715	25.08	28.905	24.39
Polycyclic Aromatic Hydrocarbons (µg/kg OC)										
Benz[a]anthracene	<100000	<85000	<93000	<100000	NR	**11000**	**13000**	<74000	<95000	<85000
Benzo(a)pyrene	**14000**	<85000	<93000	<100000	NR	**17000**	**19000**	<74000	<95000	<85000
Chrysene	**13000**	<85000	<93000	<100000	NR	**24000**	**21000**	**7500**	<95000	<85000
Dibenz[a,h]anthracene	<100000	<85000	<93000	<100000	NR	<85000	<77000	<74000	<95000	<85000
Polychlorinated Biphenyls (µg/kg OC)										
Aroclor 1016	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Aroclor 1242	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Aroclor 1248	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Aroclor 1254	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Aroclor 1260	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)										
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG85S06	97CG85D06	97CG85S07	97CG85S08	97CG85S09	97CG85S10	97CG85D10	97CG85S11	97CG85S12	97CG85S13
Pesticides (µg/kg OC; cont.)										
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG85S14	97CG85S15	97CG85S16	97CG85S17	97CG85S18	97CG85S19	98CG50S01 East Pond #5	98CG50S02 East Pond #19	98CG50S03 West Pond #7
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1997	1997	1997	1997	1997	1997	1998	1998	1998
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6165	41.6165	41.6168	41.6168	41.6168	41.6171	41.616	41.6171	41.6158
Longitude	-87.2761	-87.2757	-87.2761	-87.2757	-87.2754	-87.2754	-87.2764	-87.2754	-87.2788
Percent TOC	1	1	1	1	1	1	0.51	0.14	0.69
Percent Moisture	24.28	32.72	29.305	24.48	43.385	86.995	62.825	23.91395	36.29805
Polycyclic Aromatic Hydrocarbons (μg/kg OC)									
Benz[a]anthracene	<98000	**12000**	<90000	<82000	<230000	**71000**	<176000	<929000	**159000**
Benzo(a)pyrene	<98000	**16000**	<90000	**11000**	**24000**	**110000**	<176000	<929000	**203000**
Chrysene	<98000	**18000**	<90000	**8700**	<230000	**89000**	<176000	<929000	**188000**
Dibenz[a,h]anthracene	<98000	<100000	<90000	<82000	<230000	<510000	<176000	<929000	<493000
Polychlorinated Biphenyls (μg/kg OC)									
Aroclor 1016	<10000	<10000	<10000	<10000	<10000	<50000	<19600	<35700	<14500
Aroclor 1242	<10000	<10000	<10000	<10000	<10000	<50000	<19600	<35700	<14500
Aroclor 1248	<10000	<10000	<10000	<10000	<10000	<50000	<19600	<35700	<14500
Aroclor 1254	<10000	<10000	<10000	<10000	<10000	<50000	<19600	<35700	<14500
Aroclor 1260	<10000	<10000	<10000	<10000	<10000	<50000	<19600	<35700	**49300**
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	**49300**
Pesticides (μg/kg OC)									
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	97CG85S14	97CG85S15	97CG85S16	97CG85S17	97CG85S18	97CG85S19	98CG50S01 East Pond #5	98CG50S02 East Pond #19	98CG50S03 West Pond #7
Pesticides (µg/kg OC; cont.)									
Endrin	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**98CG50S04** **West Pond #18**	**98CG50S14** **West Lake #1**	**98CG50S15** **West Lake #16**	**98CG50S16** **West Lake #18**	**98CG50S17** **West Lake #21**	**98CG50S18** **West Lake #28**	**98CG50D18** **West Lake #28**	**98CG50S19** **West Lake #32**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6163	41.6115	41.6132	41.6132	41.6136	41.6136	41.6136	41.6136
Longitude	-87.2787	-87.2947	-87.2797	-87.2784	-87.2872	-87.2826	-87.2826	-87.2787
Percent TOC	0.02	15.8	1	0.42	1.12	0.67	0.62	0.54
Percent Moisture	36.9915	53.5119	83.8709	15.8068	42.48405	83.4444	43.0279	78.0715
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**2350000**	**354000**	**380000**	**78600**	**893000**	**806000**	**1080000**	**500000**
Benzo(a)pyrene	**3100000**	**392000**	**510000**	**107000**	**1250000**	**925000**	**1450000**	**519000**
Chrysene	**2550000**	**278000**	**430000**	**92900**	**982000**	**627000**	**823000**	**407000**
Dibenz[a,h]anthracene	<8000000	**30400**	<610000	<117000	**277000**	<1790000	<2260000	**88900**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<350000	<633	<25000	<14300	<22300	<29900	<41900	<27800
Aroclor 1242	<350000	<633	<25000	<14300	<22300	<29900	<41900	<27800
Aroclor 1248	<350000	<633	**25000**	<14300	**50000**	**53700**	**72600**	**35200**
Aroclor 1254	<350000	<633	<25000	<14300	<22300	<29900	<41900	<27800
Aroclor 1260	<350000	**2340**	<25000	<14300	<22300	<29900	<41900	<27800
Total PCBs[1]	NR	**2340**	**25000**	NR	**50000**	**53700**	**72600**	**35200**
Pesticides (µg/kg OC)								
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**98CG50S04** **West Pond #18**	**98CG50S14** **West Lake #1**	**98CG50S15** **West Lake #16**	**98CG50S16** **West Lake #18**	**98CG50S17** **West Lake #21**	**98CG50S18** **West Lake #28**	**98CG50D18** **West Lake #28**	**98CG50S19** **West Lake #32**
Pesticides (µg/kg OC; cont.)								
Endrin	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	NR
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**98CG50S20** **West Lake #33**	**98CG50S21** **West Lake #40**	**98CG50S22** **Middle Lake #2**	**98CG50S23** **Middle Lake #6**	**98CG50S24** **Middle Lake #16**	**98CG50S25** **Middle Lake #18**	**98CG50S26** **Middle Lake #22**	**98CG50S27** **East Lake #7**
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	surface	surface	surface	surface	surface	surface	surface	surface
Latitude	41.6136	41.614	41.6145	41.6149	41.6153	41.6153	41.6156	41.6155
Longitude	-87.278	-87.2777	-87.2753	-87.2738	-87.2712	-87.27	-87.2726	-87.2662
Percent TOC	0.55	0.84	0.51	0.32	0.49	0.57	0.45	0.38
Percent Moisture	81.01575	37.9047	72.62075	63.9134	79.88155	83.24319	74.02264	76.15445
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**291000**	**214000**	**133000**	**116000**	**286000**	**789000**	**162000**	**605000**
Benzo(a)pyrene	**345000**	**250000**	**143000**	**131000**	**306000**	**947000**	**204000**	**737000**
Chrysene	**273000**	**202000**	**118000**	**109000**	**265000**	**789000**	**178000**	**553000**
Dibenz[a,h]anthracene	<473000	<250000	<353000	<275000	<490000	<526000	<400000	<526000
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<36400	<23800	<25500	<31300	NR	<35100	<31100	<39500
Aroclor 1242	<36400	<23800	<25500	<31300	NR	<35100	<31100	<39500
Aroclor 1248	<36400	**16700**	<25500	<31300	NR	<35100	<31100	<39500
Aroclor 1254	<36400	<23800	<25500	<31300	NR	**221000**	<31100	<39500
Aroclor 1260	<36400	<23800	<25500	<31300	NR	<35100	<31100	<39500
Total PCBs[1]	NR	**16700**	NR	NR	NR	**221000**	NR	NR
Pesticides (µg/kg OC)								
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	**2890**
Dieldrin	NR	NR	NR	NR	NR	NR	NR	<1840

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	98CG50S20 West Lake #33	98CG50S21 West Lake #40	98CG50S22 Middle Lake #2	98CG50S23 Middle Lake #6	98CG50S24 Middle Lake #16	98CG50S25 Middle Lake #18	98CG50S26 Middle Lake #22	98CG50S27 East Lake #7
Pesticides (µg/kg OC; cont.)								
Endrin	NR	NR	NR	NR	NR	NR	NR	<1840
Heptachlor	NR	NR	NR	NR	NR	NR	NR	<1050
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	<1050
Lindane	NR	NR	NR	NR	NR	NR	NR	<1050
p,p'-DDD	NR	NR	NR	NR	NR	NR	NR	**21300**
p,p'-DDE	NR	NR	NR	NR	NR	NR	NR	**65800**
p,p'-DDT	NR	NR	NR	NR	NR	NR	NR	**21100**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**98CG50S28** **East Lake #10**	**98CG50S29** **East Lake #13**	**98CG50S30** **East Lake #29**	**98CG50S31** **East Lake #34**
Geographic Area	GCRL	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL	GCRL
Sampling Year	1998	1998	1998	1998
Depth (ft)	surface	surface	surface	surface
Latitude	41.6155	41.6155	41.617	41.6174
Longitude	-87.2645	-87.2628	-87.2617	-87.2597
Percent TOC	0.6	0.8	0.87	0.52
Percent Moisture	79.21405	77.66135	77.3433	82.9404
Polycyclic Aromatic Hydrocarbons (µg/kg OC)				
Benz[a]anthracene	**717000**	**825000**	**552000**	**2500000**
Benzo(a)pyrene	**967000**	**812000**	**586000**	**2500000**
Chrysene	**833000**	**937000**	**621000**	**2310000**
Dibenz[a,h]anthracene	<400000	<262000	<241000	<1130000
Polychlorinated Biphenyls (µg/kg OC)				
Aroclor 1016	<33300	<25000	<23000	<38500
Aroclor 1242	<33300	<25000	<23000	<38500
Aroclor 1248	<33300	<25000	<23000	<38500
Aroclor 1254	<33300	<25000	<23000	<38500
Aroclor 1260	<33300	<25000	<23000	<38500
Total PCBs[1]	NR	NR	NR	NR
Pesticides (µg/kg OC)				
Chlordane[1]	**7500**	**9500**	**3560**	**37700**
Dieldrin	**4330**	<1250	<920	<1540

Table A3.13 Sediment chemistry data used to assess injury to human uses of fishery resources (Simon 2000; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**98CG50S28**	**98CG50S29**	**98CG50S30**	**98CG50S31**
Sample	**East Lake #10**	**East Lake #13**	**East Lake #29**	**East Lake #34**
Pesticides (µg/kg OC; cont.)				
Endrin	**2330**	<1250	<920	<1540
Heptachlor	<833	<625	<460	<769
Heptachlor epoxide	<833	<625	<460	<769
Lindane	<833	<625	<460	<769
p,p'-DDD	**13000**	**18900**	**8740**	**1010000**
p,p'-DDE	**65700**	**67500**	**48600**	**1030000**
p,p'-DDT	**14700**	**14100**	**10100**	**758000**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**A-M** **ECH-E-AM01**	**A-M** **ECH-E-AM02**	**A-M** **ECH-E-AM03**	**A-N** **ECH-E-AN01_1**	**A-N** **ECH-E-AN01_2**	**A-S** **ECH-E-AS01**	**B-M** **BCORE01SD**	**B-M** **BCORE02SD_1**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	0-0.33	0.33 - 0.66	0.66 - 0.98	0-0.33	0-0.33	0-0.33	0-1.80	1.80 - 3.94
Latitude	41.6133	41.6133	41.6133	41.6134	41.6134	41.6132	41.6132	41.6132
Longitude	-87.4341	-87.4341	-87.4341	-87.4341	-87.4341	-87.4341	-87.4381	-87.4381
Percent TOC	1.03	1.22	3.2	2.24	2.03	2.12	3	4.2
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benzene	<194	**27900**	**17800**	<89.3	<98.5	<189	NR	NR
Carbazole	**62100**	**1230000**	**4370000**	**49100**	**54200**	<21200	<15300	<3810
Benz[a]anthracene	**2330000**	**28700000**	**43700000**	**1030000**	**1130000**	**387000**	**833000**	**5710**
Benzo(a)pyrene	**2330000**	**19700000**	**29100000**	**982000**	**1080000**	**226000**	**600000**	<3810
Benzo(b)fluoranthene	**2330000**	**20500000**	**29700000**	**1030000**	**1080000**	**264000**	**867000**	<3810
Benzo(k)fluoranthene	**922000**	**5490000**	**8440000**	**348000**	**429000**	**56600**	**310000**	<3810
Chrysene	**2430000**	**32800000**	**43700000**	**1340000**	**1530000**	**849000**	**1070000**	**5480**
Dibenz[a,h]anthracene	**359000**	**2050000**	**3440000**	**179000**	**177000**	**61300**	<15300	<3810
Indeno(1,2,3-c,d)pyrene	**1460000**	**10700000**	**11200000**	**670000**	**690000**	**142000**	**250000**	<3810
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<44700	<36900	<14700	<25000	<26100	<42000	<3000	<3570
Aroclor 1242	<44700	<36900	<14700	<25000	<26100	<42000	<3000	<3570
Aroclor 1248	**252000**	<36900	<14700	**205000**	**192000**	<42000	<3000	<3570
Aroclor 1254	<44700	<36900	<14700	<25000	<26100	<42000	<3000	<3570
Aroclor 1260	<44700	<36900	<14700	<25000	<26100	<42000	<3000	<3570
Total PCBs[1]	**252000**	NR	NR	**205000**	**192000**	NR	NR	NR

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	A-M ECH-E-AM01	A-M ECH-E-AM02	A-M ECH-E-AM03	A-N ECH-E-AN01_1	A-N ECH-E-AN01_2	A-S ECH-E-AS01	B-M BCORE01SD	B-M BCORE02SD_1
Chlorophenols (µg/kg OC)								
2,4,6-Trichlorophenol	<45600	<73800	<150000	<25000	<26100	<42500	<30300	<7380
2,4-Dichlorophenol	<45600	<73800	<150000	<25000	<26100	<42500	<30300	<7380
Pentachlorophenol	<117000	<189000	<375000	<62500	<64000	<108000	<76700	<18600
Pesticides (µg/kg OC)								
Aldrin	<913	<746	<300	<491	<542	<849	<60.0	<73.8
Chlordane[1]	NR	**1980**	**1020**	**893**	**542**	NR	NR	**145**
Dieldrin	<1750	<1480	**625**	<982	<1030	<1650	**213**	<145
Endosulfan, total	5600	14500	11700	2770	2460	<4100	820	<364
Endrin	<1750	<1480	<594	**1470**	<1030	<1650	<120	<145
Heptachlor	<913	<746	<300	<491	<542	<849	<60.0	**73.8**
Heptachlor epoxide	**3960**	<746	<300	<491	**1920**	<849	<60.0	<73.8
Hexachlorocyclohexane-alpha	<913	<746	<300	<491	<542	<849	<60.0	<73.8
Hexachlorocyclohexane-beta	**1580**	**13300**	<300	<491	**1870**	<849	<60.0	<73.8
Lindane	<913	<746	<300	<491	**591**	<849	<60.0	<73.8
p,p'-DDD	<1750	<1480	<594	<982	<1480	<1600	<1200	<145
p,p'-DDE	<1750	<1480	<594	<982	**15800**	<1600	<1200	<145
p,p'-DDT	<1750	<1480	**1470**	<982	<1030	<1650	<1200	<145

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**B-M** **BCORE03SD**	**B-N** **ECH-E-BN01**	**B-S** **ECH-E-BS01**	**C-N** **ECH-E-CN03_1**	**D-N** **ECH-E-DN01**	**D-S** **ECH-E-DS01**	**G-M** **GCORE01SD**	**G-M** **GCORE02SD**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	3.94 - 5.68	0-0.33	0-0.33	0.66 - 0.98	0-0.33	0-0.33	0-2.10	3.08 - 6.82
Latitude	41.6132	41.6134	41.6130	41.6119	41.6128	41.6126	41.6172	41.6172
Longitude	-87.4381	-87.4381	-87.4380	-87.4494	-87.4511	-87.4514	-87.4582	-87.4582
Percent TOC	0.253	1.17	3	3	2.16	3.34	1.19	3.1
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benzene	NR	<171	300	NR	4490	<150	NR	NR
Carbazole	<16200	<23900	<63300	NR	<20400	<16800	**118000**	<3870
Benz[a]anthracene	<16200	**821000**	**1230000**	NR	**880000**	**2690000**	**1090000**	<3870
Benzo(a)pyrene	<16200	**795000**	**1000000**	NR	**1060000**	**1290000**	**840000**	<3870
Benzo(b)fluoranthene	<16200	**855000**	**367000**	NR	**1200000**	**1470000**	**1010000**	<3870
Benzo(k)fluoranthene	<16200	**333000**	<63300	NR	**407000**	<16800	<30300	<3870
Chrysene	<16200	**1030000**	**1800000**	NR	**1160000**	**6290000**	**2440000**	<3870
Dibenz[a,h]anthracene	<16200	**137000**	**180000**	NR	**218000**	**389000**	**193000**	<3870
Indeno(1,2,3-c,d)pyrene	<16200	**573000**	**633000**	NR	**880000**	**689000**	**454000**	<3870
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<15800	<47000	<25000	NR	<39800	<32900	<5970	<3550
Aroclor 1242	<15800	<47000	<25000	NR	<39800	<32900	<36100	<3550
Aroclor 1248	<15800	**538000**	**2280000**	NR	**495000**	<32900	<92400	<3550
Aroclor 1254	<15800	<47000	<25000	NR	<39800	<32900	<72300	<3550
Aroclor 1260	<15800	<47000	<25000	NR	<39800	<32900	<31100	<3550
Total PCBs[1]	NR	**538000**	**2280000**	NR	**495000**	NR	NR	NR

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	B-M BCORE03SD	B-N ECH-E-BN01	B-S ECH-E-BS01	C-N ECH-E-CN03_1	D-N ECH-E-DN01	D-S ECH-E-DS01	G-M GCORE01SD	G-M GCORE02SD
Chlorophenols (µg/kg OC)								
2,4,6-Trichlorophenol	<32000	<47900	<127000	NR	<40300	<32900	<60500	<7420
2,4-Dichlorophenol	<32000	<47900	<127000	NR	<40300	<32900	<60500	<7420
Pentachlorophenol	<79100	<120000000	<317000	48	<102000	<83800	<151000	<18700
Pesticides (µg/kg OC)								
Aldrin	<324	<940	<500	NR	<833	<689	<118	<74.2
Chlordane[1]	NR	NR	**667**	NR	**1300**	**3230**	**2000**	NR
Dieldrin	<632	<1880	**1700**	NR	<1570	<1320	<235	<145
Endosulfan, total	<1590	<4700	<2500	NR	<3980	<3320	<588	<365
Endrin	<632	<1880	<1000	NR	<1570	<1320	**1600**	<145
Heptachlor	<324	<940	<500	NR	<833	<689	**336**	<74.2
Heptachlor epoxide	<324	<940	**25700**	NR	<833	<689	**353**	<74.2
Hexachlorocyclohexane-alpha	<324	<940	<500	NR	<833	<689	<118	<74.2
Hexachlorocyclohexane-beta	<324	**1370**	**5830**	NR	<833	<689	**454**	<74.2
Lindane	<324	<940	**1170**	NR	<833	<689	<118	<74.2
p,p'-DDD	<632	<1880	<1000	NR	<1570	<1320	<235	<145
p,p'-DDE	<632	<1880	**10700**	NR	<1570	<1320	<235	<145
p,p'-DDT	<632	**3160**	<1000	NR	**3100**	<1320	<235	<145

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**G-M** **GCORE03SD_1**	**G-M** **GCORE03SD_2**	**I-M** **ECH-E-IM01**	**I-M** **ECH-E-IM02_1**	**I-M** **ECH-E-IM02_2**	**I-M** **ECH-E-IM03**	**I-M** **ICORE01SD**	**I-M** **ICORE02SD**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	6.82 - 8.50	6.82 - 8.50	0-0.33	0.33 - 0.66	0.33 - 0.66	0.66 - 0.98	0-2.43	2.43 - 5.09
Latitude	41.6172	41.6172	41.6148	41.6148	41.6148	41.6148	41.6148	41.6148
Longitude	-87.4582	-87.4582	-87.4610	-87.4610	-87.4610	-87.4610	-87.4610	-87.4610
Percent TOC	2.5	3.4	1.31	1.94	1.13	2.04	2.5	1.8
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benzene	NR	NR	382	361	531	294	NR	NR
Carbazole	<3920	<2940	<22100	**134000**	**248000**	<26500	**96000**	<6110
Benz[a]anthracene	<3920	<2940	**763000**	**5000000**	**7960000**	**1720000**	**5600000**	**11700**
Benzo(a)pyrene	<3920	<2940	**840000**	**3090000**	**4070000**	**1030000**	**2920000**	**10600**
Benzo(b)fluoranthene	<3920	<2940	**1150000**	**3560000**	**4420000**	**1470000**	**3320000**	<6110
Benzo(k)fluoranthene	<3920	<2940	**397000**	**1240000**	**1060000**	**358000**	**680000**	<6110
Chrysene	<3920	<2940	**1370000**	**9790000**	**19500000**	**3190000**	**15200000**	**14400**
Dibenz[a,h]anthracene	<3920	<2940	**107000**	**454000**	**611000**	**137000**	**400000**	<6110
Indeno(1,2,3-c,d)pyrene	<3920	<2940	**359000**	**1030000**	**1060000**	**324000**	**560000**	<6110
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<3880	<2940	<43500	<39200	<6550	<5390	<92000	<6110
Aroclor 1242	<3880	<2940	<43500	<39200	<6550	<5390	<92000	<6110
Aroclor 1248	<3880	<2940	**435000**	**304000**	**419000**	<5390	<92000	<6110
Aroclor 1254	<3880	<2940	<43500	<39200	<6550	<5390	<40000	<6110
Aroclor 1260	<3880	<2940	<43500	<39200	<6550	<5390	<18000	<6110
Total PCBs[1]	NR	NR	**435000**	**304000**	**419000**	NR	NR	NR

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	G-M GCORE03SD_1	G-M GCORE03SD_2	I-M ECH-E-IM01	I-M ECH-E-IM02_1	I-M ECH-E-IM02_2	I-M ECH-E-IM03	I-M ICORE01SD	I-M ICORE02SD
Chlorophenols (µg/kg OC)								
2,4,6-Trichlorophenol	<8000	<6180	<44300	<39700	<66400	<53900	<30400	<12800
2,4-Dichlorophenol	<8000	<6180	<44300	<39700	<66400	<53900	<30400	<12800
Pentachlorophenol	<19600	<15300	<107000	<97900	<168000	<132000	<76000	<31100
Pesticides (µg/kg OC)								
Aldrin	<80.0	<61.8	<916	<773	<1330	<1080	<60.0	<128
Chlordane[1]	NR	NR	NR	**6080**	**24100**	**3280**	**6600**	NR
Dieldrin	<152	<118	<1760	<1550	<2570	<2060	**720**	<244
Endosulfan, total	<384	<297	<4430	<3870	<6460	<5200	1940	<617
Endrin	<152	<118	<1760	<1550	**4340**	<2060	<116	<244
Heptachlor	<80.0	<61.8	<916	<773	<1330	<1080	<60.0	<128
Heptachlor epoxide	<80.0	<61.8	<916	<773	<1330	<1080	**604**	<128
Hexachlorocyclohexane-alpha	<80.0	<61.8	<916	<773	<1330	<1080	<60.0	<128
Hexachlorocyclohexane-beta	<80.0	<61.8	<916	**1290**	<1330	<1080	**600**	<128
Lindane	<80.0	<61.8	<916	<773	**1500**	<1080	**312**	<128
p,p'-DDD	<152	<118	<1760	<1550	<2570	<2060	<116	<244
p,p'-DDE	<152	<118	<1760	<1550	**8140**	<2060	**1160**	<244
p,p'-DDT	<152	<118	<1760	<1550	<2570	<2060	**216**	<244

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station **Sample**	**I-M** **ICORE03SD**	**I-N (S)** **ECH-E-IN02**	**I-N** **ECH-E-IN01**	**I-N** **ECH-E-IN03**	**I-S** **ECH-E-IS01**	**I-S** **ECH-E-IS02**	**I-S** **ECH-E-IS03**	**WETLAND1** **ECH-E-W101**	**WETLAND2** **ECH-E-W102_1**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	5.09 - 6.00	0.33 - 0.66	0-0.33	0.66 - 0.98	0-0.33	0.33 - 0.66	0.66 - 0.98	0-0.33	0-0.33
Latitude	41.6148	41.6148	41.6148	41.6148	41.6147	41.6147	41.6147	41.6130	41.6126
Longitude	-87.4610	-87.4611	-87.4611	-87.4611	-87.4609	-87.4609	-87.4609	-87.4415	-87.4502
Percent TOC	0.63	2.5	3.49	2.2	1.25	1.5	0.21	7.1	8.2
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benzene	NR	280	430	955	560	<400	<476	<84.5	<110
Carbazole	<6670	<18000	<13800	<43600	<34400	<40000	<114000	NR	NR
Benz[a]anthracene	**15900**	**1440000**	**487000**	**955000**	**664000**	**273000**	<114000	NR	NR
Benzo(a)pyrene	**7940**	**760000**	**516000**	**591000**	**440000**	**220000**	<114000	NR	NR
Benzo(b)fluoranthene	<6670	**1000000**	**688000**	**909000**	**720000**	**373000**	<114000	NR	NR
Benzo(k)fluoranthene	<6670	**204000**	**244000**	**332000**	**264000**	**133000**	<114000	NR	NR
Chrysene	**42900**	**3160000**	**745000**	**1090000**	**960000**	**207000**	<114000	NR	NR
Dibenz[a,h]anthracene	<6670	**152000**	**77400**	**72700**	**34400**	<40000	<114000	NR	NR
Indeno(1,2,3-c,d)pyrene	<6670	**268000**	**249000**	**305000**	**152000**	**93300**	<114000	NR	NR
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1016	<6510	<35600	<26900	<43200	<68000	<80000	<224000	NR	NR
Aroclor 1242	<6510	<35600	<26900	<43200	<68000	<80000	<224000	NR	NR
Aroclor 1248	<6510	<35600	<26900	<43200	<68000	<80000	<224000	NR	NR
Aroclor 1254	<6510	<35600	<26900	<43200	<68000	<80000	<224000	NR	NR
Aroclor 1260	<6510	<35600	<26900	<43200	<68000	<80000	<224000	NR	NR
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.14 Sediment chemistry data used to assess injury to human uses of fishery resources (Exponent 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station Sample	I-M ICORE03SD	I-N (S) ECH-E-IN02	I-N ECH-E-IN01	I-N ECH-E-IN03	I-S ECH-E-IS01	I-S ECH-E-IS02	I-S ECH-E-IS03	WETLAND1 ECH-E-W101	WETLAND2 ECH-E-W102_1
Chlorophenols (µg/kg OC)									
2,4,6-Trichlorophenol	<13200	<36000	<27200	<86400	<68800	<80000	<229000	NR	NR
2,4-Dichlorophenol	<13200	<36000	<27200	<86400	<68800	<80000	<229000	NR	NR
Pentachlorophenol	<33300	<88000	<68800	<218000	<176000	<200000	<571000	NR	NR
Pesticides (µg/kg OC)									
Aldrin	<133	<720	<544	<864	<1360	<1600	<4570	NR	NR
Chlordane[1]	**159**	**2240**	**1060**	**2180**	NR	NR	NR	NR	NR
Dieldrin	<254	<1400	<1060	<1730	<2720	<3130	<9050	NR	NR
Endosulfan, total	<641	<3520	<2660	<4320	<6800	<7870	<22700	NR	NR
Endrin	<254	<1400	<1060	<1730	<2720	<3130	<9050	NR	NR
Heptachlor	<133	<720	<544	<864	<1360	<1600	<4570	NR	NR
Heptachlor epoxide	<133	<720	<544	<864	<1360	<1600	<4570	NR	NR
Hexachlorocyclohexane-alpha	<133	<720	<544	<864	<1360	<1600	<4570	NR	NR
Hexachlorocyclohexane-beta	<133	<720	<544	1640	<1360	<1600	<4570	NR	NR
Lindane	<133	<720	<544	<864	<1360	<1600	<4570	NR	NR
p,p'-DDD	<254	<1400	<1060	<1730	<2720	<3130	<9050	NR	NR
p,p'-DDE	<254	<1400	<1060	<1730	<2720	<3130	<9050	NR	NR
p,p'-DDT	<254	<1400	<1060	<1730	<2720	<3130	<9050	NR	NR

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.15 Sediment chemistry data used to assess injury to human uses of fishery resources (Thermoretec 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	SD-98-16/0-2'	SD-98-16/2-4.5'	SD-98-17/2-5'	SD-98-17S/0-2'	SD-98-18/0-2'	SD-98-18/2-4'	SD-98-20/0-2'
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	0-2	2-4.5	2-5	0-2	0-2	2-4	0-2
Latitude	41.6258	41.6258	41.6257	41.6257	41.6255	41.6255	41.6253
Longitude	-87.5215	-87.5215	-87.5208	-87.5208	-87.5199	-87.5199	-87.5193
Percent TOC	12.9	8.71	10.5	4.44	8.34	7.43	14.4
Percent Moisture	63	59.8	57.4	60.4	58.7	61.3	48.7
Polycyclic Aromatic Hydrocarbons (µg/kg OC)							
Benzene	7750	**31000**	**86700**	**563000**	6830	**89500**	**306000**
Benz[a]anthracene	**41900**	<7580	**143000**	**1490000**	**116000**	**190000**	**458000**
Benzo(a)pyrene	**27900**	<7580	<314000	**1170000**	**74300**	**149000**	<903000
Benzo(k)fluoranthene	**10900**	<7580	<314000	**315000**	**22800**	**122000**	<903000
Chrysene	**51900**	<7580	**133000**	**1530000**	**132000**	**180000**	**458000**
Dibenz[a,h]anthracene	<25600	<7580	<314000	<1490000	<39600	<444000	<903000
Indeno(1,2,3-c,d)pyrene	<25600	<7580	<314000	<1490000	<39600	<444000	<903000

OC = organic carbon; TOC = total organic carbon; GCR/IHC = Grand Calumet River and Indiana Harbor Canal;
WBGCR = West Branch of the Grand Calumet River.

Table A3.15 Sediment chemistry data used to assess injury to human uses of fishery resources (Thermoretec 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**SD-98-20/2-4'**	**SD-98-20S/0-0.83**	**SD-98-22/0-2'**	**SD-98-22/2-4'**	**SD-98-24/0-2'**	**SD-98-24/2-5'**	**SD-98-24S/0-0.83**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	2-4	0-0.83	0-2	2-4	0-2	2-5	0-0.83
Latitude	41.6253	41.6253	41.6249	41.6249	41.6245	41.6245	41.6245
Longitude	-87.5193	-87.5193	-87.5186	-87.5186	-87.51785	-87.51785	-87.5179
Percent TOC	12.1	10.4	13.7	10.1	10	6.83	15
Percent Moisture	46.6	59.9	59.6	57	50	59.3	58.9
Polycyclic Aromatic Hydrocarbons (μg/kg OC)							
Benzene	<413000	**135000**	**59900**	**257000**	<500000	4830	1800
Benz[a]anthracene	**992000**	**115000**	**131000**	**465000**	**450000**	<966000	**10700**
Benzo(a)pyrene	<2730000	**88500**	**109000**	**406000**	**350000**	<966000	**9330**
Benzo(k)fluoranthene	<2730000	<250000	<241000	**119000**	<660000	<966000	**3870**
Chrysene	**826000**	**240000**	**226000**	**515000**	**440000**	<966000	**16000**
Dibenz[a,h]anthracene	<2730000	<250000	<241000	<653000	<660000	<966000	<4400
Indeno(1,2,3-c,d)pyrene	<2730000	<250000	<241000	<653000	<660000	<966000	<4400

OC = organic carbon; TOC = total organic carbon; GCR/IHC = Grand Calumet River and Indiana Harbor Canal;
WBGCR = West Branch of the Grand Calumet River.

Table A3.15 Sediment chemistry data used to assess injury to human uses of fishery resources (Thermoretec 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**SD-98-26/0-2'**	**SD-98-26/2-5'**
Geographic Area	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II
Sampling Year	1998	1998
Depth (ft)	0-2	2-5
Latitude	41.6239	41.6239
Longitude	-87.5168	-87.5168
Percent TOC	7.96	6.22
Percent Moisture	55.8	51.1
Polycyclic Aromatic Hydrocarbons (µg/kg OC)		
Benzene	<77900	<9970
Benz[a]anthracene	**176000**	**22500**
Benzo(a)pyrene	<415000	**18500**
Benzo(k)fluoranthene	<415000	**7880**
Chrysene	**176000**	**26500**
Dibenz[a,h]anthracene	<415000	<10600
Indeno(1,2,3-c,d)pyrene	<415000	<10600

OC = organic carbon; TOC = total organic carbon; GCR/IHC = Grand Calumet River and Indiana Harbor Canal;
WBGCR = West Branch of the Grand Calumet River.

Table A3.16 Sediment chemistry data used to assess injury to human uses of fishery resources (URS Greiner Woodward Clyde 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**01RA01SE00**	**01RA01SE07**	**01RA02SE00**	**01RA02SE07**	**01RA03SD10**	**01RA03SE00**	**01RA03SE10**	**01RB01SE00**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	0-0.16	2-3.7	0-0.16	2-5.5	5-8	0-0.16	5-8	0-0.16
Latitude	41.6169	41.6169	41.6182	41.6182	41.6188	41.6188	41.6188	41.6179
Longitude	-87.4867	-87.4867	-87.4877	-87.4877	-87.4881	-87.4881	-87.4881	-87.4859
Percent TOC	16.9	5.33	27.4	2.39	6.33	12	5.95	16.3
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (μg/kg OC)								
Benzene	<65.1	<131	<35.0	<230	NR	NR	NR	NR
Benz[a]anthracene	<3910	<6190	<2410	<13800	<5210	<68300	<5550	<4050
Benzo(a)pyrene	<3910	<6190	<2410	<13800	<5210	<68300	<5550	<4050
Benzo(k)fluoranthene	<3910	<6190	<2410	<13800	<5210	<68300	<5550	<4050
Chrysene	<3910	<6190	<2410	<13800	<5210	<68300	<5550	<4050
Dibenz[a,h]anthracene	<3910	<6190	<2410	<13800	<5210	<68300	<5550	<4050
Indeno(1,2,3-c,d)pyrene	<3910	<6190	<2410	<13800	<5210	<68300	<5550	<4050
Polychlorinated Biphenyls (μg/kg OC)								
Aroclor 1016	<19500	<3000	<120	<1380	<521	<27500	<555	<20200
Aroclor 1242	<19500	<3000	<120	<1380	<521	<27500	<555	<20200
Aroclor 1248	<19500	<3000	<120	<1380	<521	<27500	<555	<20200
Aroclor 1254	<19500	<3000	**117**	<1380	<521	<27500	<555	<20200
Aroclor 1260	<19500	<3000	<120	<1380	<521	<27500	<555	<20200
Total PCBs[1]	NR	NR	**117**	NR	NR	NR	NR	NR

Table A3.16 Sediment chemistry data used to assess injury to human uses of fishery resources (URS Greiner Woodward Clyde 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	01RA01SE00	01RA01SE07	01RA02SE00	01RA02SE07	01RA03SD10	01RA03SE00	01RA03SE10	01RB01SE00
Pesticides (µg/kg OC)								
Dieldrin	<2010	<1280	<124	<1420	<269	<5670	<286	<2090
Endrin	<2010	<1280	<124	<1420	<269	<5670	<286	<2090
Heptachlor	<1010	<638	<62.0	<711	<134	<2830	<143	<1040
Heptachlor epoxide	<1010	<638	<62.0	<711	<134	<2830	<143	<1040
Lindane	<1010	<638	<62.0	<711	<134	<2830	<143	<1040
p,p'-DDD	<2010	<1280	<124	<1420	<269	<5670	<286	<2090
p,p'-DDE	<2010	<1280	<124	<1420	<269	<5670	<286	<2090
p,p'-DDT	<2010	<1280	<124	<1420	<269	<5670	<286	<2090

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.16 Sediment chemistry data used to assess injury to human uses of fishery resources (URS Greiner Woodward Clyde 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**01RB01SE07**	**01RB03SD10**	**01RB03SE05**	**01RB03SE10**	**01RB03SE15**	**01RC01SE00**	**01RC01SE07**	**01RC02SE00**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1998	1998	1998	1998	1998	1998	1998	1998
Depth (ft)	2-7	5-10	0-5	5-10	10-13	0-2	2-6.5	0-5
Latitude	41.6179	41.6188	41.6188	41.6188	41.6188	41.6168	41.6168	41.6175
Longitude	-87.4859	-87.4859	-87.4859	-87.4859	-87.4859	-87.4853	-87.4853	-87.4843
Percent TOC	3.76	9.96	10.2	11.1	4.14	12.4	5.02	23.1
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (μg/kg OC)								
Benzene	NR	NR	NR	NR	<174	<58.9	<112	<36.4
Benz[a]anthracene	<8780	<3310	**83300**	<2970	<7970	<2660	<6570	<1430
Benzo(a)pyrene	<8780	<3310	<32400	<2970	<7970	<2660	<6570	<1430
Benzo(k)fluoranthene	<8780	<3310	<32400	<2970	<7970	<2660	<6570	<1430
Chrysene	<8780	<3310	**157000**	**3150**	<7970	**3230**	<6570	<1430
Dibenz[a,h]anthracene	<8780	<3310	<32400	<2970	<7970	<2660	<6570	<1430
Indeno(1,2,3-c,d)pyrene	<8780	<3310	<32400	<2970	<7970	<2660	<6570	<1430
Polychlorinated Biphenyls (μg/kg OC)								
Aroclor 1016	<878	<3310	<32400	<2970	<797	<5320	<657	<143
Aroclor 1242	<878	<3310	<32400	<2970	<797	<5320	<657	<143
Aroclor 1248	<878	<3310	<32400	<2970	<797	<5320	<657	<143
Aroclor 1254	<878	<3310	<32400	<2970	<797	<5320	<657	**563**
Aroclor 1260	<878	<3310	<32400	<2970	<797	<5320	<657	<143
Total PCBs[1]	NR	NR	NR	NR	NR	NR	NR	**563**

Table A3.16 Sediment chemistry data used to assess injury to human uses of fishery resources (URS Greiner Woodward Clyde 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	01RB01SE07	01RB03SD10	01RB03SE05	01RB03SE10	01RB03SE15	01RC01SE00	01RC01SE07	01RC02SE00
Pesticides (µg/kg OC)								
Dieldrin	<90.4	<3410	<16700	<3060	<411	<2740	<67.7	<736
Endrin	<90.4	<3410	<16700	<3060	<411	<2740	<67.7	<736
Heptachlor	<45.2	<1710	<8330	<1530	<205	<1370	<33.9	<368
Heptachlor epoxide	<45.2	<1710	<8330	<1530	<205	<1370	<33.9	<368
Lindane	<45.2	<1710	<8330	<1530	<205	<1370	<33.9	<368
p,p'-DDD	<90.4	<3410	<16700	<3060	<411	<2740	<67.7	<736
p,p'-DDE	<90.4	<3410	<16700	<3060	<411	<2740	<67.7	<736
p,p'-DDT	<90.4	<3410	<16700	<3060	<411	<2740	<67.7	<736

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.16 Sediment chemistry data used to assess injury to human uses of fishery resources (URS Greiner Woodward Clyde 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**01RC02SE07**	**01RC03SE00**	**01RC03SE10**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC
Reach	WBGCR II	WBGCR II	WBGCR II
Sampling Year	1998	1998	1998
Depth (ft)	2-3.5	0-0.16	5-9.5
Latitude	41.6175	41.6179	41.6179
Longitude	-87.4843	-87.4838	-87.4838
Percent TOC	4.2	17.5	2.92
Percent Moisture	NR	NR	NR
Polycyclic Aromatic Hydrocarbons (µg/kg OC)			
Benzene	<200	<274000	<260
Benz[a]anthracene	<7860	<286000	<11300
Benzo(a)pyrene	<7860	<286000	<11300
Benzo(k)fluoranthene	<7860	<286000	<11300
Chrysene	<7860	<286000	<11300
Dibenz[a,h]anthracene	<7860	<286000	<11300
Indeno(1,2,3-c,d)pyrene	<7860	<286000	<11300
Polychlorinated Biphenyls (µg/kg OC)			
Aroclor 1016	<3810	<18900	<1130
Aroclor 1242	<3810	<18900	<1130
Aroclor 1248	<3810	<18900	<1130
Aroclor 1254	<3810	<18900	<1130
Aroclor 1260	<3810	<18900	<1130
Total PCBs[1]	NR	NR	NR

Table A3.16 Sediment chemistry data used to assess injury to human uses of fishery resources (URS Greiner Woodward Clyde 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	01RC02SE07	01RC03SE00	01RC03SE10
Pesticides (µg/kg OC)			
Dieldrin	<810	<19400	<1160
Endrin	<810	<19400	<1160
Heptachlor	<405	<9710	<582
Heptachlor epoxide	<405	<9710	<582
Lindane	<405	<9710	<582
p,p'-DDD	<810	<19400	<1160
p,p'-DDE	<810	<19400	<1160
p,p'-DDT	<810	<19400	<1160

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; WBGCR = West Branch of the Grand Calumet River.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**GC99E1**	**GC99E2**	**GC99E3**	**GC99S01**	**GC99S015**	**GC99S02**	**GC99S03**	**GC99S04**	**GC99S05**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-5	5-6.29	6.29-10	0-0.33	0-0.33	0-0.33	0-0.33	0-0.33	0-0.33
Latitude	41.6154	41.6154	41.6154	41.60945	41.61075	41.61195	41.619366667	41.62315	41.61545
Longitude	-87.467233333	-87.467233333	-87.467233333	-87.388083333	-87.42075	-87.420066667	-87.4195	-87.424	-87.466666667
Percent TOC	12	8.1	0.55	14	14	0.17	4.8	7.2	14
Percent Moisture	56.5	46	21	83	68	23	63	65	58
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benz[a]anthracene	**102000**	NR	**34500**	<6930	**43600**	<124000	<18500	<13100	**57900**
Benzo(a)pyrene	**55800**	**70400**	**30900**	**2140**	**60000**	<124000	<18500	<13100	**62900**
Benzo(b)fluoranthene	**86700**	**122000**	**38200**	**3070**	**65000**	<124000	<18500	<13100	**85700**
Benzo(k)fluoranthene	**32900**	**38300**	**11800**	**2140**	**54300**	<124000	<18500	<13100	**31400**
Chrysene	**103000**	**222000**	**52700**	**2500**	**53600**	<124000	<18500	<13100	**63600**
Dibenz[a,h]anthracene	**8580**	**9140**	**3820**	<6930	**12100**	<124000	<18500	<13100	**8570**
Indeno(1,2,3-c,d)pyrene	**23800**	**27200**	**10200**	<6930	**32900**	<124000	<18500	<13100	**27900**
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1016	<1580	<1850	<3820	<693	<371	<12400	<937	<653	<1430
Aroclor 1242	<1580	<1850	<3820	<693	<371	<12400	<937	<653	<1430
Aroclor 1248	**371000**	**173000**	**30900**	<693	**17900**	<12400	<937	<653	**54300**
Aroclor 1254	<1580	<1850	<3820	<693	<371	<12400	<937	**1150**	<1430
Aroclor 1260	<1580	<1850	<3820	<693	<371	<12400	<937	<653	<1430
Total PCBs[1]	**371000**	**173000**	**30900**	NR	**17900**	NR	NR	**1150**	**54300**
Phthalates (µg/kg OC)									
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99E1	GC99E2	GC99E3	GC99S01	GC99S015	GC99S02	GC99S03	GC99S04	GC99S05
Chlorophenols (µg/kg OC)									
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)									
Aldrin	<642	<383	<382	<69.3	<186	<1240	<937	<333	<143
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<1250	<753	<764	<136	<371	<2530	<185	<653	<279
Endosulfan, total	<3140	<1890	<1910	<341	<929	<6290	<1310	<1640	<700
Endrin	<1250	<753	<764	<136	<371	<2530	<185	<653	<279
Heptachlor	<642	<383	<382	<69.3	<186	<1240	<937	<333	<143
Heptachlor epoxide	<642	<383	<382	<69.3	<186	<1240	<937	<333	<143
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<642	<383	<382	<69.3	<186	<1240	<937	<333	<143
p,p'-DDD	<1250	<753	<764	<136	<371	<2530	<185	<653	<279
p,p'-DDE	<1250	<753	<764	<136	<371	<2530	<185	<653	<279
p,p'-DDT	<1250	<753	<764	<136	<371	<2530	<185	<653	<279

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99S05A	GC99S06	GC99T01C1	GC99T01C2	GC99T01C3	GC99T01CS	GC99T01L1	GC99T01LS
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-0.33	0-0.33	0-5	5-9	9-10	0-0.33	0-3	0-0.33
Latitude	41.6155	41.61575	41.608	41.608	41.608	41.608	41.608	41.608
Longitude	-87.466666667	-87.468683333	-87.393316667	-87.393316667	-87.393316667	-87.393316667	-87.3931	-87.3931
Percent TOC	11	9.9	7.2	10	13	9	0.34	1.1
Percent Moisture	55	70	44	67	73	23	24	30
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**16400**	**34300**	**472000**	**2500000**	**6080**	**11000000**	**11500000**	**14500000**
Benzo(a)pyrene	**19100**	**40400**	**264000**	**1200000**	<23800	**10100000**	**10900000**	**16400000**
Benzo(b)fluoranthene	**23600**	**48500**	**431000**	**2100000**	<23800	**7780000**	**9410000**	**15500000**
Benzo(k)fluoranthene	**9000**	**27300**	**306000**	**1200000**	<23800	**6330000**	**6760000**	**10000000**
Chrysene	**18200**	**73700**	**486000**	**2500000**	**7230**	**10600000**	**11200000**	**12700000**
Dibenz[a,h]anthracene	**2360**	<28300	NR	NR	<23800	**956000**	**735000**	NR
Indeno(1,2,3-c,d)pyrene	**8550**	**15200**	**153000**	**720000**	<23800	**2780000**	**3240000**	**4820000**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<3360	<556	<2080	<2500	<923	<1220	<32400	<10900
Aroclor 1242	<3360	<556	<2080	<2500	<923	<1220	<32400	<10900
Aroclor 1248	**63600**	**2120**	**18100**	**36000**	**408**	**267000**	**471000**	**409000**
Aroclor 1254	<3360	<556	<2080	<2500	<923	<1220	<32400	<10900
Aroclor 1260	<3360	<556	<2080	<2500	<923	<1220	<32400	<10900
Total PCBs[1]	**63600**	**2120**	**18100**	**36000**	**408**	**267000**	**471000**	**409000**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99S05A	GC99S06	GC99T01C1	GC99T01C2	GC99T01C3	GC99T01CS	GC99T01L1	GC99T01LS
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<664	<55.6	<819	<1000	<46.9	<4780	<12600	<4270
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<1360	<111	<1670	<2000	<92.3	<9560	<25600	<8550
Endosulfan, total	<3390	<278	<4150	<5000	<232	<23900	<63800	<21400
Endrin	<1360	<111	<1670	<2000	<92.3	<9560	<25600	<8550
Heptachlor	<664	<55.6	<819	<1000	<46.9	<4780	<12600	<4270
Heptachlor epoxide	<664	<55.6	<819	<1000	<46.9	<4780	<12600	<4270
Hexachlorocyclohexane-alpha	<664	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	<664	NR	NR	NR	NR	NR	NR	NR
Lindane	<664	<55.6	<819	<1000	<46.9	<4780	<12600	<4270
p,p'-DDD	<1360	<111	<1670	<2000	<92.3	<9560	<25600	<8550
p,p'-DDE	<1360	<111	<1670	<2000	<92.3	<9560	<25600	<8550
p,p'-DDT	<1360	<111	<1670	<2000	<92.3	<9560	<25600	<8550

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T01R1	GC99T01R2	GC99T01R3	GC99T02C1	GC99T02CS	GC99T02L1	GC99T02L2	GC99T02R1
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-5	5-7.92	7.92-10	0-5	0-0.33	0-3	3-5	0-5
Latitude	41.608166667	41.608166667	41.608166667	41.609083333	41.609083333	41.609	41.609	41.6092
Longitude	-87.393116667	-87.393116667	-87.393116667	-87.410716667	-87.410716667	-87.4114	-87.4114	-87.411216667
Percent TOC	8.5	7.6	13	9.6	11	7.5	0.8	10
Percent Moisture	49	54	74	53	34	60	24	55
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**98200**	**88200**	<24600	**156000**	**209000**	**40000**	**32500**	**46000**
Benzo(a)pyrene	**68800**	**63200**	<24600	**146000**	**336000**	**34700**	**42500**	**37000**
Benzo(b)fluoranthene	**94100**	**59200**	<24600	**135000**	**327000**	**38700**	**41200**	**37000**
Benzo(k)fluoranthene	**65900**	**67100**	<24600	**115000**	**264000**	**28000**	**36200**	**31000**
Chrysene	**124000**	**111000**	<24600	**167000**	**218000**	**46700**	**38700**	**51000**
Dibenz[a,h]anthracene	NR	NR	<24600	<7290	**48200**	<5470	<27500	<3700
Indeno(1,2,3-c,d)pyrene	**25900**	**17100**	<24600	**68700**	**155000**	**17300**	<27500	**19000**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<1880	<2370	<1000	<1870	<1180	<547	<2750	<1800
Aroclor 1242	<1880	<2370	<1000	<1870	<1180	<547	<2750	<1800
Aroclor 1248	**2470**	<2370	<1000	**5310**	**12700**	**733**	<2750	**13000**
Aroclor 1254	<1880	<2370	<1000	<1870	<1180	<547	<2750	<1800
Aroclor 1260	<1880	<2370	<1000	<1870	<1180	<547	<2750	<1800
Total PCBs[1]	**2470**	NR	NR	**5310**	**12700**	**733**	NR	**13000**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	<27500	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	<27500	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T01R1	GC99T01R2	GC99T01R3	GC99T02C1	GC99T02CS	GC99T02L1	GC99T02L2	GC99T02R1
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	<27500	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	<137000	NR
Pesticides (µg/kg OC)								
Aldrin	<765	<947	<48.5	<187	<118	<54.7	<275	<180
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<1530	<1840	<100	<365	<227	<111	<538	<370
Endosulfan, total	<3820	<4630	<248	<917	<573	<276	<1350	<920
Endrin	<1530	<1840	<100	<365	<227	<111	<538	<370
Heptachlor	<765	<947	<48.5	<187	<118	<54.7	<275	<180
Heptachlor epoxide	<765	<947	<48.5	<187	<118	<54.7	<275	<180
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<765	<947	<48.5	<187	<118	<54.7	<275	<180
p,p'-DDD	<1530	<1840	<100	<365	<227	<111	<538	<370
p,p'-DDE	<1530	<1840	<100	<365	<227	<111	<538	<370
p,p'-DDT	<1530	<1840	<100	<365	<227	<111	<538	<370

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T02R2	GC99T02R3	GC99T02RS	GC99T03C1	GC99T03C2	GC99T03CS	GC99T03L1	GC99T03L2
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	5-7.25	7.25-10	0-0.33	0-5	5-10	0-0.33	0-5	5-10
Latitude	41.6092	41.6092	41.6092	41.6101	41.6101	41.6101	41.609866667	41.609866667
Longitude	-87.411216667	-87.411216667	-87.411216667	-87.420416667	-87.420416667	-87.420416667	-87.420566667	-87.420566667
Percent TOC	9.1	10	10	11.15	2.3	9.6	10	8.1
Percent Moisture	55	67	51	46	35	39	59	51
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**67000**	**2300**	**150000**	**341000**	**196000**	**115000**	**570000**	**39500**
Benzo(a)pyrene	**56000**	<5000	**120000**	**233000**	**161000**	**115000**	**340000**	**21000**
Benzo(b)fluoranthene	**57100**	<5000	**120000**	**269000**	**178000**	**135000**	**430000**	**30900**
Benzo(k)fluoranthene	**44000**	<5000	**97000**	**130000**	**95700**	**63500**	**210000**	**13600**
Chrysene	**76900**	**2900**	**150000**	**269000**	**143000**	**81200**	**440000**	**29600**
Dibenz[a,h]anthracene	<3700	<5000	**3200**	**29600**	**19600**	**15600**	**51000**	**3090**
Indeno(1,2,3-c,d)pyrene	**30800**	<5000	**64000**	**97300**	**73900**	**56200**	**170000**	**9750**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<1980	<500	<1700	<5560	<5650	<1460	<2000	<2100
Aroclor 1242	<1980	<500	<1700	<5560	<5650	<1460	<2000	<2100
Aroclor 1248	<1980	<500	**150000**	**117000**	**20900**	**25000**	**120000**	<2100
Aroclor 1254	<1980	<500	<1700	<5560	<5650	<1460	<2000	<2100
Aroclor 1260	<1980	<500	**23000**	<5560	<5650	<1460	<2000	<2100
Total PCBs[1]	NR	NR	**173000**	**117000**	**20900**	**25000**	**120000**	NR
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T02R2	GC99T02R3	GC99T02RS	GC99T03C1	GC99T03C2	GC99T03CS	GC99T03L1	GC99T03L2
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<198	<50.0	<170	<556	<2220	<562	<800	<827
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<407	<100	<340	<1080	<4350	<1150	<1600	<1600
Endosulfan, total	<1010	<250	<850	<2710	<10900	<2850	<4000	<4040
Endrin	<407	<100	<340	<1080	<4350	<1150	<1600	<1600
Heptachlor	<198	<50.0	<170	<556	<2220	<562	<800	<827
Heptachlor epoxide	<198	<50.0	<170	<556	<2220	<562	<800	<827
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<198	<50.0	<170	<556	<2220	<562	<800	<827
p,p'-DDD	<407	<100	<340	<1080	<4350	<1150	<1600	<1600
p,p'-DDE	<407	<100	<340	<1080	<4350	<1150	<1600	<1600
p,p'-DDT	<407	<100	<340	<1080	<4350	<1150	<1600	<1600

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T03L3	GC99T03R1	GC99T03R2	GC99T03RS	GC99T04C1	GC99T04C2	GC99T04C3	GC99T04CS
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	10-15	0-5	5-10	0-0.33	0-5	5-6.5	6.5-9.29	0-0.33
Latitude	41.609866667	41.610166667	41.610166667	41.610166667	41.612833333	41.612833333	41.612833333	41.612833333
Longitude	-87.420566667	-87.420616667	-87.420616667	-87.420616667	-87.431316667	-87.431316667	-87.431316667	-87.431316667
Percent TOC	0.32	12	0.45	13	7.7	2.6	0.23	6.1
Percent Moisture	26	55	22	62	62	43	20	29
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**10300**	**258000**	**8670**	**146000**	**83100**	**10400**	**3390**	**136000**
Benzo(a)pyrene	**8440**	**167000**	**8000**	**115000**	**55800**	**23800**	**3610**	**134000**
Benzo(b)fluoranthene	**10000**	**217000**	**8670**	**138000**	**74000**	**23500**	**3780**	**164000**
Benzo(k)fluoranthene	**4380**	**100000**	**3780**	**63100**	**33800**	**10000**	**1650**	**75400**
Chrysene	**8440**	**200000**	**7330**	**115000**	**63600**	**7310**	**2960**	**102000**
Dibenz[a,h]anthracene	<6880	**23300**	<4670	**14600**	**7270**	**2770**	<9130	**19700**
Indeno(1,2,3-c,d)pyrene	<6880	**76700**	<4670	**41500**	**27300**	**13100**	<9130	**72100**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<6880	<1500	<4670	<1690	<1130	<1120	<9130	<1970
Aroclor 1242	<6880	<1500	<4670	<1690	<1130	<1120	<9130	<1970
Aroclor 1248	<6880	**225000**	**37800**	**423000**	<1130	**4230**	<9130	**2300**
Aroclor 1254	<6880	<1500	<4670	<1690	<1130	<1120	<9130	<1970
Aroclor 1260	<6880	<1500	<4670	<1690	<1130	<1120	<9130	<1970
Total PCBs[1]	NR	**225000**	**37800**	**423000**	NR	**4230**	NR	**2300**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T03L3	GC99T03R1	GC99T03R2	GC99T03RS	GC99T04C1	GC99T04C2	GC99T04C3	GC99T04CS
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<688	<608	<467	<669	<558	<112	<913	<377
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<1410	<1250	<933	<1310	<1130	<223	<1780	<754
Endosulfan, total	<3500	<3110	<2330	<3280	<2820	<558	<4480	<1890
Endrin	<1410	<1250	<933	<1310	<1130	<223	<1780	<754
Heptachlor	<688	<608	<467	<669	<558	<112	<913	<377
Heptachlor epoxide	<688	<608	<467	<669	<558	<112	<913	<377
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<688	<608	<467	<669	<558	<112	<913	<377
p,p'-DDD	<1410	<1250	<933	<1310	<1130	<223	<1780	<754
p,p'-DDE	<1410	<1250	<933	<1310	<1130	<223	<1780	<754
p,p'-DDT	<1410	<1250	<933	<1310	<1130	<223	<1780	<754

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T04L1	GC99T04L2	GC99T04R1	GC99T04RS	GC99T05C1	GC99T05C2	GC99T05C3	GC99T05CS
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-5	5-10	0-5	0-0.33	0-5	5-6.63	6.63-10.72	0-0.33
Latitude	41.6126	41.6126	41.6131	41.6131	41.6121	41.6121	41.6121	41.6121
Longitude	-87.4314	-87.4314	-87.43125	-87.43125	-87.442916667	-87.442916667	-87.442916667	-87.442916667
Percent TOC	4.5	3.4	1.8	8.8	3.7	4.8	14	6.3
Percent Moisture	51	41	49	54	24	49	71	39
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**109000**	**241**	**6110**	**85200**	**227000**	**58300**	**1210**	**114000**
Benzo(a)pyrene	**91100**	**224**	**2940**	**79500**	**151000**	**54200**	**1000**	**111000**
Benzo(b)fluoranthene	**111000**	**382**	**7780**	**92000**	**238000**	**60400**	**1360**	**157000**
Benzo(k)fluoranthene	**48900**	**121**	**3440**	**40900**	**78400**	**25000**	**650**	**63500**
Chrysene	**95600**	**206**	**4560**	**63600**	NR	**62500**	**1360**	**125000**
Dibenz[a,h]anthracene	**11300**	<824	<3610	**10100**	**26800**	**6460**	<786	**22200**
Indeno(1,2,3-c,d)pyrene	**42200**	<824	**2940**	**30700**	**75700**	**25000**	**600**	**63500**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<756	<824	<8890	<2050	<2970	<3330	<407	<2220
Aroclor 1242	<756	<824	<8890	<2050	<2970	<3330	<407	<2220
Aroclor 1248	<756	<824	<8890	**58000**	**27000**	**8750**	<407	**27000**
Aroclor 1254	<756	<824	<8890	<2050	<2970	<3330	<407	<2220
Aroclor 1260	<756	<824	<8890	<2050	<2970	<3330	<407	<2220
Total PCBs[1]	NR	NR	NR	**58000**	**27000**	**8750**	NR	**27000**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T04L1	GC99T04L2	GC99T04R1	GC99T04RS	GC99T05C1	GC99T05C2	GC99T05C3	GC99T05CS
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<378	<82.4	<1780	<818	<297	<333	<40.7	<222
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<756	<165	<3610	<1590	<595	<667	<78.6	<429
Endosulfan, total	<1890	<412	<9000	<4000	<1490	<1670	<198	<1080
Endrin	<756	<165	<3610	<1590	<595	<667	<78.6	<429
Heptachlor	<378	<82.4	<1780	<818	<297	<333	<40.7	<222
Heptachlor epoxide	<378	<82.4	<1780	<818	<297	<333	<40.7	<222
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<378	<82.4	<1780	<818	<297	<333	<40.7	<222
p,p'-DDD	<756	<165	<3610	<1590	<595	<667	<78.6	<429
p,p'-DDE	<756	<165	<3610	<1590	<595	<667	<78.6	<429
p,p'-DDT	<756	<165	<3610	<1590	<595	<667	<78.6	<429

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T05L1	GC99T05L2	GC99T05R1	GC99T05R2	GC99T05R3	GC99T05RS	GC99T06C1	GC99T06CS
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-5	5-8	0-5	5-7.75	7.75-10	0-0.33	0-5	0-0.33
Latitude	41.612083333	41.612083333	41.612433333	41.612433333	41.612433333	41.612433333	41.614	41.614
Longitude	-87.442666667	-87.442666667	-87.442766667	-87.442766667	-87.442766667	-87.442766667	-87.4622	-87.4622
Percent TOC	6.5	0.14	10	9.3	0.41	10	0.53	0.59
Percent Moisture	64	21	74	69	22	49	26	28
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**43100**	<15000	**24000**	**1830**	**1560**	**47000**	**43400**	**271000**
Benzo(a)pyrene	**33800**	**4000**	**23000**	**1610**	<5120	**50000**	**52800**	**305000**
Benzo(b)fluoranthene	**49200**	**7860**	**31000**	**2900**	**1540**	**70000**	**60400**	**407000**
Benzo(k)fluoranthene	**16900**	**2210**	**11000**	**892**	<5120	**27000**	**26400**	**153000**
Chrysene	**66200**	**9290**	**32000**	**3440**	**3900**	**66000**	**47200**	**390000**
Dibenz[a,h]anthracene	**4770**	<15000	**3100**	<1180	<5120	**8500**	**6420**	**40700**
Indeno(1,2,3-c,d)pyrene	**15400**	<15000	**9900**	**914**	<5120	**29000**	**28300**	**144000**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<708	<15000	<630	<570	<5120	<1600	<4150	<18600
Aroclor 1242	<708	<15000	<630	<570	<5120	<1600	<4150	<18600
Aroclor 1248	<708	<15000	<630	**3330**	**12700000**	**12000**	**9060**	**147000**
Aroclor 1254	<708	<15000	<630	<570	<5120	<1600	<4150	<18600
Aroclor 1260	<708	<15000	<630	<570	<5120	<1600	<4150	<18600
Total PCBs[1]	NR	NR	NR	**3330**	**12700000**	**12000**	**9060**	**147000**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T05L1	GC99T05L2	GC99T05R1	GC99T05R2	GC99T05R3	GC99T05RS	GC99T06C1	GC99T06CS
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<354	<1500	<63.0	<57.0	<512	<160	<415	<7800
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<708	<3000	<130	<118	<1020	<320	<849	<15600
Endosulfan, total	<1770	<7500	<323	<294	<2560	<800	<2110	<39000
Endrin	<708	<3000	<130	<118	<1020	<320	<849	<15600
Heptachlor	<354	<1500	<63.0	<57.0	<512	<160	<415	<7800
Heptachlor epoxide	<354	<1500	<63.0	<57.0	<512	<160	<415	<7800
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<354	<1500	<63.0	<57.0	<512	<160	<415	<7800
p,p'-DDD	<708	<3000	<130	<118	<1020	<320	<849	<15600
p,p'-DDE	<708	<3000	<130	<118	<1020	<320	<849	**1860**
p,p'-DDT	<708	<3000	<130	<118	<1020	<320	<849	<15600

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T06L1	GC99T06L2	GC99T06L3	GC99T06L4	GC99T06LS	GC99T06R1	GC99T06R2	GC99T07C1	GC99T07CS
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I	EBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-5	5-10	10-11	11-13.16	0-0.33	0-5	5.25-9.5	0-5	0-0.33
Latitude	41.615	41.615	41.615	41.615	41.615	41.6139	41.6139	41.617216667	41.617216667
Longitude	-87.4622	-87.4622	-87.4622	-87.4622	-87.4622	-87.4622	-87.4622	-87.46875	-87.46875
Percent TOC	7.1	8.5	4.7	5.5	10	3.7	0.96	2.8	6.1
Percent Moisture	34	39	31	62	53	46	29	36	60
Polycyclic Aromatic Hydrocarbons (μg/kg OC)									
Benz[a]anthracene	**169000**	**247000**	**87200**	**436**	**69000**	<838	<2400	**6790**	**59000**
Benzo(a)pyrene	**183000**	**75300**	**76600**	<782	**84000**	<838	<2400	**5710**	NR
Benzo(b)fluoranthene	**211000**	**153000**	**100000**	**582**	**110000**	<838	<2400	**10700**	NR
Benzo(k)fluoranthene	**88700**	**37600**	NR	**142**	**45000**	<838	<2400	**3360**	NR
Chrysene	**169000**	NR	**126000**	**873**	**77000**	<838	<2400	**15400**	NR
Dibenz[a,h]anthracene	**18300**	**6240**	**10200**	<782	**4200**	<838	<2400	**1290**	**12600**
Indeno(1,2,3-c,d)pyrene	**85900**	**31800**	**34000**	<782	**43000**	<838	<2400	**3930**	**44300**
Polychlorinated Biphenyls (μg/kg OC)									
Aroclor 1016	<1830	<1650	<2550	<782	<1800	<838	<2400	<929	<672
Aroclor 1242	<1830	<1650	<2550	<782	<1800	<838	<2400	<929	<672
Aroclor 1248	**28200**	**30600**	**100000**	<782	**23000**	<838	<2400	**8570**	**41000**
Aroclor 1254	<1830	<1650	<2550	<782	<1800	<838	<2400	<929	<672
Aroclor 1260	**2110**	**2000**	<2550	<782	**3100**	<838	<2400	<929	<672
Total PCBs[1]	**30300**	**32600**	**100000**	NR	**26100**	NR	NR	**8570**	**41000**
Phthalates (μg/kg OC)									
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T06L1	GC99T06L2	GC99T06L3	GC99T06L4	GC99T06LS	GC99T06R1	GC99T06R2	GC99T07C1	GC99T07CS
Chlorophenols (µg/kg OC)									
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)									
Aldrin	<183	<165	<511	<78.2	<180	<83.8	<240	<929	<1360
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<352	<318	<1020	<158	<350	<165	<479	<1860	<2790
Endosulfan, total	<887	<800	<2550	<395	<880	<414	<1200	<4640	<6930
Endrin	<352	<318	<1020	<158	<350	<165	<479	<1860	<2790
Heptachlor	<183	<165	<511	<78.2	<180	<83.8	<240	<929	<1360
Heptachlor epoxide	<183	<165	<511	<78.2	<180	<83.8	<240	<929	<1360
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<183	<165	<511	<78.2	<180	<83.8	<240	<929	<1360
p,p'-DDD	<352	<318	<1020	<158	<350	<165	**50**	<1860	<2790
p,p'-DDE	<352	<318	<1020	<158	<350	<165	<479	<1860	<2790
p,p'-DDT	<352	<318	<1020	<158	<350	<165	**56.3**	<1860	<2790

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T07L1	GC99T07L2	GC99T07R1	GC99T07RS	IHC99S07	IHC99T09C1	IHC99T09CS	IHC99T09L1
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	EBGCR I	EBGCR I	EBGCR I	EBGCR I	IHC	IHC	IHC	IHC
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-5	5-10	0-3	0-0.33	0-0.33	0-0.33	0-0.33	0-4
Latitude	41.609	41.609	41.6173	41.6173	41.633533333	41.622416667	41.622416667	41.622566667
Longitude	-87.4115	-87.4115	-87.4687	-87.4687	-87.467983333	-87.471116667	-87.471116667	-87.471216667
Percent TOC	6.6	5.1	0.32	7.3	13	2.3	3.1	0.6
Percent Moisture	58	54.5	20	31	71	27	35	21
Polycyclic Aromatic Hydrocarbons (μg/kg OC)								
Benz[a]anthracene	**87900**	**8430**	**306000**	**260000**	<4380	**152000**	**326000**	**53300**
Benzo(a)pyrene	**78800**	**11200**	**438000**	**132000**	**1150**	**187000**	**322000**	**48300**
Benzo(b)fluoranthene	**112000**	**16300**	**938000**	**370000**	<4380	**204000**	**355000**	**51700**
Benzo(k)fluoranthene	**42400**	**6080**	**244000**	NR	<4380	**104000**	**165000**	**23300**
Chrysene	**152000**	**16000**	**1810000**	NR	**1150**	**326000**	**597000**	**86700**
Dibenz[a,h]anthracene	**11200**	**1250**	**37500**	**10300**	<4380	**29100**	**50000**	**15200**
Indeno(1,2,3-c,d)pyrene	**30300**	**6570**	**253000**	**82200**	<4380	**60900**	**109000**	**25000**
Polychlorinated Biphenyls (μg/kg OC)								
Aroclor 1016	<3030	<765	<31300	<1640	<438	<4780	<4190	<7000
Aroclor 1242	<3030	<765	<31300	<1640	<438	<4780	<4190	<7000
Aroclor 1248	**11800**	**12500**	**109000**	**23300**	<438	**69600**	**41900**	**23300**
Aroclor 1254	<3030	<765	<31300	<1640	<438	<4780	<4190	<7000
Aroclor 1260	<3030	<765	<31300	<1640	<438	<4780	<4190	<7000
Total PCBs[1]	**11800**	**12500**	**109000**	**23300**	NR	**69600**	**41900**	**23300**
Phthalates (μg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T07L1	GC99T07L2	GC99T07R1	GC99T07RS	IHC99S07	IHC99T09C1	IHC99T09CS	IHC99T09L1
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<303	<76.5	<6560	<658	<43.8	<1000	<806	<350
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<591	<155	<12800	<1320	<84.6	<1960	<1650	<700
Endosulfan, total	<1480	<363	<32200	<3290	<213	<4910	<4100	<1750
Endrin	<591	<155	<12800	<1320	<84.6	<1960	<1650	<700
Heptachlor	<303	<76.5	<6560	<658	<43.8	<1000	<806	<350
Heptachlor epoxide	<303	<76.5	<6560	<658	<43.8	<1000	<806	<350
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<303	<76.5	<6560	<658	<43.8	<1000	<806	<350
p,p'-DDD	<591	<155	<12800	<1320	<84.6	<1960	<1650	<700
p,p'-DDE	<591	<155	<12800	<1320	<84.6	<1960	<1650	<700
p,p'-DDT	<591	<155	<12800	<1320	**11.5**	<1960	<1650	<700

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHC99T09LS	IHC99T09R1	IHC99T10C1	IHC99T10CS	IHC99T10L1	IHC99T10R1	IHC99T10RS	IHC99T11C1
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	IHC	IHC	IHC	IHC	IHC	IHC	IHC	LGB
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-0.33	0-5	0-5	0-0.33	0-5	0-3	0-0.33	0-5
Latitude	41.622566667	41.6217	41.6366	41.6366	41.636366667	41.6368	41.6368	41.6468
Longitude	-87.471216667	-87.470883333	-87.471216667	-87.471216667	-87.471266667	-87.4709	-87.4709	-87.486066667
Percent TOC	1.1	0.51	8.2	2.2	2	1.4	4.9	6.65
Percent Moisture	23	21	47	31	42	22	26	31
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**109000**	**54900**	**110000**	**327000**	**145000**	**250000**	**306000**	**123000**
Benzo(a)pyrene	**109000**	**51000**	**75600**	**423000**	**85000**	**136000**	**180000**	**94700**
Benzo(b)fluoranthene	**118000**	**54900**	**84100**	**382000**	**100000**	**200000**	**265000**	**78900**
Benzo(k)fluoranthene	**59100**	**23500**	**62200**	**255000**	**90000**	**78600**	**116000**	**22600**
Chrysene	**218000**	**102000**	**171000**	**455000**	**150000**	**593000**	**776000**	**196000**
Dibenz[a,h]anthracene	**6270**	**15100**	**8050**	NR	NR	NR	**26500**	**40600**
Indeno(1,2,3-c,d)pyrene	**39100**	**27500**	**18300**	**150000**	**27500**	**37100**	**42900**	**40600**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<3910	<8240	<3780	<5450	<7000	<7860	<4490	<7220
Aroclor 1242	<3910	<8240	<3780	<5450	<7000	<7860	<4490	<7220
Aroclor 1248	**31800**	**19600**	**31700**	**45500**	**13000**	**66400**	**100000**	**82000**
Aroclor 1254	<3910	<8240	<3780	<5450	<7000	<7860	<4490	<7220
Aroclor 1260	<3910	<8240	<3780	<5450	<7000	<7860	<4490	2780
Total PCBs[1]	**31800**	**19600**	**31700**	**45500**	**13000**	**66400**	**100000**	**84700**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**IHC99T09LS**	**IHC99T09R1**	**IHC99T10C1**	**IHC99T10CS**	**IHC99T10L1**	**IHC99T10R1**	**IHC99T10RS**	**IHC99T11C1**
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<1000	<412	<378	<545	<700	<786	<918	<3610
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<1000	<824	<756	<1090	<1400	<1500	<1820	<7220
Endosulfan, total	<4820	<2060	<1890	<2730	<3500	<3790	<4550	<18000
Endrin	<1910	<824	<756	<1090	<1400	<1500	<1820	<7220
Heptachlor	<1000	<412	<378	<545	<700	<786	<918	<3610
Heptachlor epoxide	<1000	<412	<378	<545	<700	<786	<918	<3610
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<1000	<412	<378	<545	<700	<786	<918	<3610
p,p'-DDD	<1910	<824	<756	<1090	<1400	<1500	<1820	<7220
p,p'-DDE	<1910	<824	<756	<1090	<1400	<1500	<1820	<7220
p,p'-DDT	**282**	**90.2**	<756	<1090	<1400	**393**	<1820	<7220

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHC99T11C2	IHC99T11C3	IHC99T11CS	IHC99T11L1	IHC99T11R1	IHC99T11R2	IHC99T11RS	IHC99T12C1
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	LGB	LGB	LGB	LGB	LGB	LGB	LGB	LGB
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	5-10	10-14.5	0-0.33	0-2	0-5	5-9.67	0-0.33	0-5
Latitude	41.6468	41.6468	41.6468	41.646983333	41.646616667	41.646616667	41.646616667	41.646716667
Longitude	-87.486066667	-87.486066667	-87.486066667	-87.486383333	-87.48645	-87.48645	-87.48645	-87.493466667
Percent TOC	12	4.9	3.6	5	2.1	3.5	1.8	21
Percent Moisture	42	27	28	24	20	21	19	83
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**375000**	**198000**	**97200**	**60000**	**181000**	**457000**	**261000**	**31900**
Benzo(a)pyrene	**367000**	**245000**	**114000**	<22000	<47600	<28600	**306000**	**25200**
Benzo(b)fluoranthene	**200000**	**106000**	**91700**	**70000**	**176000**	**234000**	**167000**	**19000**
Benzo(k)fluoranthene	**69200**	**55100**	**33300**	<22000	<47600	**129000**	**66700**	<46200
Chrysene	**650000**	**245000**	**169000**	**90000**	**281000**	**543000**	**378000**	**61900**
Dibenz[a,h]anthracene	**83300**	**77600**	**27800**	<22000	<47600	<28600	**88900**	<46200
Indeno(1,2,3-c,d)pyrene	**78300**	**59200**	**36100**	**22000**	**52400**	**68600**	**77800**	<46200
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<2330	<9180	<12800	<2200	<4760	<2860	<11100	<23300
Aroclor 1242	<2330	<9180	<12800	<2200	<4760	<2860	<11100	<23300
Aroclor 1248	**5500**	**3060**	**77800**	**36000**	**47600**	**6290**	**39400**	**176000**
Aroclor 1254	<2330	<9180	<12800	<2200	<4760	<2860	<11100	<23300
Aroclor 1260	<2330	<9180	**6670**	<2200	<4760	<2860	<11100	<23300
Total PCBs[1]	**5500**	**3060**	**84400**	**36000**	**47600**	**6290**	**39400**	**176000**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHC99T11C2	IHC99T11C3	IHC99T11CS	IHC99T11L1	IHC99T11R1	IHC99T11R2	IHC99T11RS	IHC99T12C1
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<475	<918	<3060	<4400	<1950	<6000	<2280	<4620
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<917	<1840	<6390	<8600	<3950	<12000	<4500	<9050
Endosulfan, total	<2310	<4590	<15800	<21600	<9860	<24000	<11300	<22700
Endrin	<917	<1840	<6390	<8600	<3950	<12000	<4500	<9050
Heptachlor	<475	<918	<3060	<4400	<1950	<6000	<2280	<4620
Heptachlor epoxide	<475	<918	<3060	<4400	<1950	<6000	<2280	<4620
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<475	<918	<3060	<4400	<1950	<6000	<2280	<4620
p,p'-DDD	<917	<1840	<6390	<8600	<3950	<12000	<4500	<9050
p,p'-DDE	<917	<1840	<6390	<8600	<3950	<12000	<4500	<9050
p,p'-DDT	<917	<1840	<6390	<8600	<3950	<12000	<4500	<9050

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**IHC99T12C2**	**IHC99T12C3**	**IHC99T12CS**	**IHC99T12L1**	**IHC99T12L2**	**IHC99T12L3**	**IHC99T12LS**	**IHC99T12R1**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	LGB	LGB	LGB	LGB	LGB	LGB	LGB	LGB
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	5-10	10-14	0-0.33	0-5	5-10	10-13.41	10-13.41	0-5
Latitude	41.646716667	41.646716667	41.646716667	41.646983333	41.646983333	41.646983333	41.646983333	41.646416667
Longitude	-87.493466667	-87.493466667	-87.493466667	-87.4935	-87.4935	-87.4935	-87.4935	-87.493
Percent TOC	15	1.7	14	22	14	7	16	16
Percent Moisture	64	27.8	82	76	57	26	80	53
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**260000**	**18200**	<65700	**132000**	**236000**	**67100**	<51900	**18800**
Benzo(a)pyrene	**273000**	**23500**	**26400**	**132000**	**264000**	**74300**	**16900**	<11300
Benzo(b)fluoranthene	**147000**	**13500**	**32900**	**77300**	**143000**	**38600**	**20000**	**13800**
Benzo(k)fluoranthene	**48000**	**8240**	<65700	**30500**	**50000**	**17100**	<51900	<11300
Chrysene	**413000**	**26500**	**31400**	**227000**	**343000**	**117000**	**26300**	**29400**
Dibenz[a,h]anthracene	**73300**	<13500	<65700	**39100**	**64300**	<31400	<51900	<11300
Indeno(1,2,3-c,d)pyrene	**62700**	<13500	**14300**	**39100**	**55000**	**22900**	<51900	<11300
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<6130	<6470	<6570	<6360	<5500	<3140	<10600	<1130
Aroclor 1242	<6130	<6470	<6570	<6360	<5500	<3140	<10600	<1130
Aroclor 1248	<6130	**2240**	**27900**	**50000**	<5500	**5860**	**48800**	**18100**
Aroclor 1254	<6130	<6470	<6570	<6360	<5500	<3140	<10600	<1130
Aroclor 1260	<6130	<6470	<6570	<6360	<5500	<3140	**6880**	<1130
Total PCBs[1]	NR	**2240**	**27900**	**50000**	NR	**5860**	**55600**	**18100**
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHC99T12C2	IHC99T12C3	IHC99T12CS	IHC99T12L1	IHC99T12L2	IHC99T12L3	IHC99T12LS	IHC99T12R1
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<3070	<135	<1290	<3140	<1360	<643	<2560	<438
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<6130	<271	<2640	<6360	<2710	<1270	<5190	<875
Endosulfan, total	<15300	<676	<6570	<15900	<6790	<3190	<12900	<2190
Endrin	<6130	<271	<2640	<6360	<2710	<1270	<5190	<875
Heptachlor	<3070	<135	<1290	<3140	<1360	<643	<2560	<438
Heptachlor epoxide	<3070	<135	<1290	<3140	<1360	<643	<2560	<438
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<3070	<135	<1290	<3140	<1360	<643	<2560	<438
p,p'-DDD	<6130	<271	<2640	<6360	<2710	**357**	<5190	<875
p,p'-DDE	<6130	<271	<2640	<6360	<2710	<1270	**750**	<875
p,p'-DDT	<6130	<271	<2640	<6360	<2710	<1270	<5190	<875

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	**IHC99T12R2**	**LG99S08**	**LG99S09**	**LG99T13C1**	**LG99T13CS**	**LG99T13L1**	**LG99T13R1**	**LG99T13R2**
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	LGB	LGB	LGB	LGB	LGB	LGB	LGB	LGB
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	5-7.17	0-0.33	0-0.33	0-4.75	0-0.33	0-4.75	0-5	5-8.33
Latitude	41.646416667	41.644966667	41.645016667	41.646616667	41.646616667	41.646833333	41.646583333	41.646583333
Longitude	-87.493	-87.493316667	-87.501816667	-87.500833333	-87.500833333	-87.500316667	-87.501116667	-87.501116667
Percent TOC	3.935	3.6	2	4	9.75	1.1	4.3	0.75
Percent Moisture	36	25	50	56	85.5	20	58	19
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**85100**	<12200	**25000**	<47500	**11300**	<90900	**39500**	<26700
Benzo(a)pyrene	**41300**	<12200	<33000	**140000**	<60500	<90900	<46500	<26700
Benzo(b)fluoranthene	**31100**	<12200	<33000	**110000**	<60500	<90900	**39500**	<26700
Benzo(k)fluoranthene	**56700**	<12200	<33000	<47500	<60500	<90900	<46500	<26700
Chrysene	**71200**	<12200	**55000**	**115000**	**19000**	<90900	**65100**	**10100**
Dibenz[a,h]anthracene	**18400**	<12200	<33000	<47500	<60500	<90900	<46500	<26700
Indeno(1,2,3-c,d)pyrene	**16500**	<12200	<33000	<47500	<60500	<90900	<46500	<26700
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<18600	<3060	<8500	<4750	<6050	<9090	<4650	<13300
Aroclor 1242	<18600	<3060	<8500	<4750	<6050	<9090	<4650	<13300
Aroclor 1248	**46300**	<3060	**2750**	<4750	**2490**	<9090	<4650	<13300
Aroclor 1254	<18600	<3060	<8500	<4750	**3410**	<9090	<4650	<13300
Aroclor 1260	<18600	<3060	<8500	<4750	<6050	<9090	<4650	<13300
Total PCBs[1]	**46300**	NR	**2750**	NR	**5900**	NR	NR	NR
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	IHC99T12R2	LG99S08	LG99S09	LG99T13C1	LG99T13CS	LG99T13L1	LG99T13R1	LG99T13R2
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<4570	<61.1	<165	<1880	<2460	<191	<1840	<267
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<9400	<122	<330	<3750	<4820	<373	<3720	<547
Endosulfan, total	<23400	<306	<825	<9380	<12100	<936	<9280	<1360
Endrin	<9400	<122	<330	<3750	<4820	<373	<3720	<547
Heptachlor	<4570	<61.1	<165	<1880	<2460	<191	<1840	<267
Heptachlor epoxide	<4570	<61.1	<165	<1880	<2460	<191	<1840	<267
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<4570	<61.1	<165	<1880	<2460	<191	<1840	<267
p,p'-DDD	<9400	<122	<330	<3750	<4820	<373	<3720	<547
p,p'-DDE	<9400	<122	**95**	<3750	<4820	<373	**3260**	**3600**
p,p'-DDT	<9400	<122	**100**	<3750	<4820	<373	<3720	<547

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	LG99T13RS	LG99T14C1	LG99T14CS	LG99T14L1	LG99T14LS	LG99T14R1	GC99T08C1	GC99T08C2
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Reach	LGB	LGB	LGB	LGB	LGB	LGB	WBGCR I	WBGCR I
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-0.33	0-3.42	0-0.33	0-0.33	0-0.33	0-3.67	0-5	5-10
Latitude	41.646583333	41.6465	41.6465	41.64665	41.64665	41.646567	41.615483333	41.615483333
Longitude	-87.501116667	-87.506333333	-87.506333333	-87.506633333	-87.506633333	-87.5065	-87.474566667	-87.474566667
Percent TOC	6.7	3	7.6	1.5	17	3.1	6.3	2.4
Percent Moisture	79	51	89	33	89	47	55	40
Polycyclic Aromatic Hydrocarbons (µg/kg OC)								
Benz[a]anthracene	**10700**	**63300**	<98700	**100000**	<44100	**54800**	**302000**	**187000**
Benzo(a)pyrene	<58200	**93300**	<98700	**140000**	<44100	**80600**	**54000**	**22100**
Benzo(b)fluoranthene	<58200	<56700	<98700	<80000	<44100	**51600**	**159000**	**91700**
Benzo(k)fluoranthene	<58200	<56700	<98700	<80000	<44100	**25200**	**30200**	**16200**
Chrysene	**19400**	**80000**	<98700	**127000**	<44100	**80600**	**667000**	**417000**
Dibenz[a,h]anthracene	<58200	<56700	<98700	<80000	<44100	<51600	**17500**	**11200**
Indeno(1,2,3-c,d)pyrene	<58200	<56700	<98700	<80000	<44100	<51600	**31700**	**24600**
Polychlorinated Biphenyls (µg/kg OC)								
Aroclor 1016	<5820	<5670	<9870	<8000	<4410	<5160	<5870	<11700
Aroclor 1242	<5820	<5670	<9870	<8000	<4410	<5160	<5870	<11700
Aroclor 1248	<5820	<5670	**3290**	<8000	**1470**	**1680**	<5870	<11700
Aroclor 1254	<5820	<5670	<9870	<8000	<4410	<5160	<5870	<11700
Aroclor 1260	<5820	<5670	<9870	<8000	<4410	<5160	<5870	<11700
Total PCBs[1]	NR	NR	**3290**	NR	**1470**	**1680**	NR	NR
Phthalates (µg/kg OC)								
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	LG99T13RS	LG99T14C1	LG99T14CS	LG99T14L1	LG99T14LS	LG99T14R1	GC99T08C1	GC99T08C2
Chlorophenols (µg/kg OC)								
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)								
Aldrin	<2390	<2230	<3950	<3270	<441	<2000	<1160	<1170
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	<4630	<4330	<7890	<6600	<882	<3870	<2380	<2290
Endosulfan, total	<11600	<10900	<19700	<16500	<2210	<9740	<5920	<5750
Endrin	<4630	<4330	<7890	<6600	<882	<3870	<2380	<2290
Heptachlor	<2390	<2230	<3950	<3270	<441	<2000	<1160	<1170
Heptachlor epoxide	<2390	<2230	<3950	<3270	<441	<2000	<1160	<1170
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	NR	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	NR	NR	NR	NR
Lindane	<2390	<2230	<3950	<3270	<441	<2000	<1160	<1170
p,p'-DDD	<4630	<4330	<7890	<6600	<882	<3870	<2380	<2290
p,p'-DDE	**403**	<4330	<7890	<6600	**241**	**742**	<2380	<2290
p,p'-DDT	<4630	<4330	<7890	<6600	<882	<3870	<2380	<2290

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T08CS	GC99T08L1	GC99T08L2	GC99T08L3	GC99T08R1	GC99T08R2	GC99T08RS	ML99S10	ML99S11
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCRL	GCRL
Reach	WBGCR I	WBGCR I	WBGCR I	WBGCR I	WBGCR I	WBGCR I	WBGCR I	GCRL	GCRL
Sampling Year	1999	1999	1999	1999	1999	1999	1999	1999	1999
Depth (ft)	0-0.33	0-5	5-9.5	9.5-10	0-5	5-10	0-0.33	0-0.33	0-0.33
Latitude	41.615483333	41.615616667	41.615616667	41.615616667	41.6153	41.6153	41.6153	41.616216667	41.615883333
Longitude	-87.474566667	-87.47465	-87.47465	-87.47465	-87.4747	-87.4747	-87.4747	-87.262766667	-87.27055
Percent TOC	40	6.1	8.6	6.6	1.7	0.13	12	13	9.9
Percent Moisture	37	51	57	66	29	21	43	72	81.5
Polycyclic Aromatic Hydrocarbons (µg/kg OC)									
Benz[a]anthracene	**350000**	**262000**	**140000**	**11200**	**1060000**	**846000**	**1670000**	**33800**	**6670**
Benzo(a)pyrene	**27500**	**50800**	**77900**	**3940**	**276000**	**285000**	**442000**	**48500**	**9040**
Benzo(b)fluoranthene	**168000**	**139000**	**128000**	**11400**	**365000**	**369000**	**617000**	**50800**	**8280**
Benzo(k)fluoranthene	**27500**	NR	NR	**2730**	**33500**	<162000	**45000**	**43100**	**6670**
Chrysene	**825000**	NR	**198000**	**19700**	**1530000**	**1380000**	**2670000**	**44600**	**6670**
Dibenz[a,h]anthracene	**19500**	**7050**	**5230**	**652**	<27100	<162000	<24200	<22300	<18200
Indeno(1,2,3-c,d)pyrene	**35000**	**32800**	**33700**	**2580**	**153000**	**215000**	<24200	**35400**	**6570**
Polychlorinated Biphenyls (µg/kg OC)									
Aroclor 1016	<1300	<2790	<2210	<3640	<27100	<323000	<4830	<454	<929
Aroclor 1242	<1300	<2790	<2210	<3640	<27100	<323000	<4830	<454	<929
Aroclor 1248	**1330**	<2790	<2210	<3640	<27100	<323000	<4830	**538**	**1820**
Aroclor 1254	<1300	<2790	<2210	<3640	<27100	<323000	<4830	<454	<929
Aroclor 1260	<1300	<2790	<2210	<3640	<27100	<323000	<4830	<454	<929
Total PCBs[1]	**1330**	NR	NR	NR	NR	NR	NR	**538**	**1820**
Phthalates (µg/kg OC)									
Bis(2-ethylhexyl)phthalate	NR	NR	NR	NR	NR	NR	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	GC99T08CS	GC99T08L1	GC99T08L2	GC99T08L3	GC99T08R1	GC99T08R2	GC99T08RS	ML99S10	ML99S11
Chlorophenols (µg/kg OC)									
2,4-Dichlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pentachlorophenol	NR	NR	NR	NR	NR	NR	NR	NR	NR
Pesticides (µg/kg OC)									
Aldrin	<650	<1100	<895	<74.2	<2710	<1620	<4830	<223	<92.9
Chlordane[1]	NR	NR	NR	NR	NR	NR	NR	**423**	NR
Dieldrin	<1300	<2130	<1740	<147	<5470	<3230	<10000	<454	<182
Endosulfan, total	<3250	<5360	<4380	<368	<13600	<8080	<24800	<1130	<457
Endrin	<1300	<2130	<1740	<147	<5470	<3230	<10000	<454	<182
Heptachlor	<650	<1100	<895	<74.2	<2710	<1620	<4830	<223	<92.9
Heptachlor epoxide	<650	<1100	<895	<74.2	<2710	<1620	<4830	<223	<92.9
Hexachlorocyclohexane-alpha	NR	NR	NR	NR	<2710	<1620	<4830	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR	NR	<2710	<1620	<4830	NR	NR
Lindane	<650	<1100	<895	<74.2	<2710	<1620	<4830	<223	<92.9
p,p'-DDD	<1300	<2130	<1740	<147	<5470	<3230	<10000	**177**	<182
p,p'-DDE	<1300	<2130	<1740	<147	<5470	<3230	<10000	**623**	<182
p,p'-DDT	<1300	<2130	<1740	<147	<5470	<3230	<10000	**177**	**85.4**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River
GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	ML99S12	ML99S13	ML99S14
Geographic Area	GCRL	GCRL	GCRL
Reach	GCRL	GCRL	GCRL
Sampling Year	1999	1999	1999
Depth (ft)	0-0.33	0-0.33	0-0.33
Latitude	41.613916667	41.613366667	41.613883333
Longitude	-87.27775	-87.281216667	-87.28405
Percent TOC	13	11	13
Percent Moisture	83	80	81
Polycyclic Aromatic Hydrocarbons (µg/kg OC)			
Benz[a]anthracene	<37700	**12700**	**11500**
Benzo(a)pyrene	**12300**	**22700**	**20800**
Benzo(b)fluoranthene	**11500**	**19100**	**20000**
Benzo(k)fluoranthene	**7690**	**17300**	**14600**
Chrysene	**10000**	**14500**	**13800**
Dibenz[a,h]anthracene	<37700	<15500	<13100
Indeno(1,2,3-c,d)pyrene	<37700	**17300**	**14600**
Polychlorinated Biphenyls (µg/kg OC)			
Aroclor 1016	<746	<755	<669
Aroclor 1242	<746	<755	<669
Aroclor 1248	**500**	**573**	**1380**
Aroclor 1254	<746	<755	<669
Aroclor 1260	<746	<755	<669
Total PCBs[1]	**500**	**573**	**1380**
Phthalates (µg/kg OC)			
Bis(2-ethylhexyl)phthalate	NR	NR	NR
2,4,6-Trichlorophenol	NR	NR	NR

Table A3.17 Sediment chemistry data used to assess injury to human uses of fishery resources (Maxim Technologies 1999; bolded values indicate an exceedance of the bioaccumulation-based benchmarks for sediment chemistry; Table 2).

Station	ML99S12	ML99S13	ML99S14
Chlorophenols (µg/kg OC)			
2,4-Dichlorophenol	NR	NR	NR
Pentachlorophenol	NR	NR	NR
Pesticides (µg/kg OC)			
Aldrin	<74.6	<75.5	<66.9
Chlordane[1]	NR	NR	NR
Dieldrin	<146	<155	<131
Endosulfan, total	<367	<385	<328
Endrin	<146	<155	<131
Heptachlor	<74.6	<75.5	<66.9
Heptachlor epoxide	<74.6	<75.5	<66.9
Hexachlorocyclohexane-alpha	NR	NR	NR
Hexachlorocyclohexane-beta	NR	NR	NR
Lindane	<74.6	<75.5	<66.9
p,p'-DDD	<146	<155	<131
p,p'-DDE	<146	<155	<131
p,p'-DDT	**28.5**	**30.9**	**76.9**

OC = organic carbon; TOC = total organic carbon; PCBs = polychlorinated biphenyls; NR = not reported; GCR/IHC = Grand Calumet River and Indiana Harbor Canal; EBGCR = East Branch of the Grand Calumet River, IHC = Indiana Harbor Canal; LGB = Lake George Branch; WBGCR = West Branch of the Grand Calumet River GCRL = Grand Calumet River Lagoons.

[1]Calculated or reported total (see Section 3.2 for a description of data treatment).

Appendix 4

Summary for the Whole-Sediment Chemistry Data Tables

Table A4.1 Summary of the whole-sediment chemistry data for surficial sediments in the Grand Calumet River/Indiana Harbor Canal.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	79	70.35	326.69	1070.05	19621.63	345289.67	2834.59	320186.52	2847.08	17.52	7586956.68
Carbazole	5	51079.36	54187.19	62135.92	96000.00	108456.89	71490.33	23321.14	71490.38	49107.14	117647.05
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	240	22593.43	63249.84	190237.95	596706.74	1711383.57	201631.59	815159.99	201635.49	1044.03	25782609.23
Benzo(a)pyrene	226	27702.74	72622.60	166410.06	424645.88	1159335.33	184421.84	639113.81	184424.58	1153.85	16695652.52
Benzo(b)fluoranthene	80	36563.23	72998.28	147976.20	387911.15	1089722.66	178271.42	573383.34	178273.36	3071.43	15454545.12
Benzo(k)fluoranthene	160	19429.29	32538.16	79364.36	311320.37	1486801.33	115055.63	631830.44	115058.05	2142.86	12260869.82
Chrysene	244	24042.40	73552.34	224762.40	791414.67	2360682.61	236769.54	852318.32	236773.34	1153.85	25478261.40
Dibenz[a,h]anthracene	104	8053.50	12954.79	28446.07	89165.38	295778.33	36558.68	94180.05	36559.99	1285.71	2147058.76
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	149	21364.31	36567.17	82926.83	314210.53	1364273.23	118772.05	514136.42	118773.80	2944.44	14695652.48
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.1 Summary of the whole-sediment chemistry data for surficial sediments in the Grand Calumet River/Indiana Harbor Canal.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	8	82932.54	131253.03	163770.57	257036.22	500843.57	181319.98	109405.19	181320.24	57959.18	526315.78
Aroclor 1248	136	8777.62	24023.03	77918.30	226239.72	756967.66	70973.13	201751.07	70976.80	733.33	4170731.80
Aroclor 1254	16	805.51	6574.15	29287.90	68261.01	230089.50	17726.42	82960.21	17738.62	116.79	539823.01
Aroclor 1260	7	2338.43	2638.36	3100.00	4603.91	10940.66	4178.07	3438.82	4178.30	2112.68	23000.00
Total PCBs	154	3798.23	23561.00	84590.52	206778.06	614307.42	61392.44	196327.98	61410.51	44.17	4170731.80
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	14	13218.60	15174.99	20675.50	23647.59	33099.21	20817.73	5090.01	20817.81	12500.00	63333.33
2,4,6-Trichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pentachlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	27	578.39	741.21	1362.86	8124.06	12084.73	2099.45	3835.94	2100.23	366.87	17083.33
Dieldrin	40	209.67	320.00	921.07	4576.97	10549.58	1333.37	3161.98	1334.71	166.52	17272.73

Table A4.1 Summary of the whole-sediment chemistry data for surficial sediments in the Grand Calumet River/Indiana Harbor Canal.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	13	78.89	267.97	798.18	1031.39	1635.03	534.12	359.92	535.32	53.19	4335.66
p,p'-DDE	32	537.95	777.21	3276.78	11903.12	24241.09	3159.93	6895.96	3162.15	95.00	55909.09
p,p'-DDT	23	116.69	297.26	863.56	4072.62	8623.62	994.75	2647.12	999.46	11.54	20000.00
Endosulfan, total	93	359.47	819.44	1695.45	3400.00	7928.79	1598.41	1803.72	1599.43	106.54	16093.75
Endrin	54	61.39	122.01	193.06	233.30	250.00	168.79	62.67	169.02	42.31	1596.64
Heptachlor	17	524.53	863.56	2880.00	8671.33	9409.37	2569.59	4155.00	2570.53	336.13	36944.45
Heptachlor epoxide	12	607.97	834.89	2190.52	3179.44	3912.65	1949.00	1781.18	1949.62	352.94	25733.33
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	6	521.80	737.28	1471.10	1794.96	3304.64	1363.79	802.91	1364.14	453.78	5833.33
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	14	377.97	1177.34	2201.53	4664.35	14976.10	2325.39	4018.66	2326.95	153.47	25416.67
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	15	0.00002	0.00002	0.00004	0.72	2.87	0.001	1.704	0.47	0.000003	6.20

OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p* -dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p* -dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).
[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.
[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.
[4]The geometric mean was not calculated using the $\log_e$ transformed data.
[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).
Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Table A4.2 Summary of the whole-sediment chemistry data for surficial sediments in the Grand Calumet River Lagoons.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Carbazole	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	114	11834.81	19082.79	67992.65	353317.54	918697.78	94704.57	822565.46	94706.61	6666.67	45080439.62
Benzo(a)pyrene	125	13391.13	20000.00	69230.77	387500.00	1023076.35	92547.23	444811.97	92548.90	7857.14	16528924.69
Benzo(b)fluoranthene	5	9457.30	11538.46	19090.91	20000.00	34976.29	17929.03	7855.51	17929.21	8282.83	50769.23
Benzo(k)fluoranthene	6	7161.15	9031.23	15888.60	34278.74	207278.76	28677.41	216060.84	28678.47	6666.67	997375.33
Chrysene	127	13000.00	21000.00	73000.00	352590.02	873533.88	92335.04	419257.83	92336.78	6666.67	14435695.54
Dibenz[a,h]anthracene	28	16602.75	30594.68	54543.56	167582.24	333851.08	67485.08	104324.05	67486.25	3333.33	1074380.10
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	4	8347.20	11965.47	15888.60	20664.51	28535.10	15562.02	5861.49	15562.21	6565.66	35384.62
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.2 Summary of the whole-sediment chemistry data for surficial sediments in the Grand Calumet River Lagoons.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	5	14378.11	20000.00	37500.00	59090.91	104983.54	37953.35	25879.41	37953.77	11538.46	154000.00
Aroclor 1248	11	538.46	890.61	16666.67	41943.54	53731.34	6641.89	17385.02	6645.15	500.00	72580.64
Aroclor 1254	4	33880.43	40662.11	85907.14	176708.25	202115.75	83640.83	74835.80	83641.21	30000.00	221052.63
Aroclor 1260	13	5743.53	10000.00	13000.00	30000.00	38448.57	15007.08	8494.95	15007.55	2341.77	49275.36
Total PCBs	29	1160.60	10000.00	25000.00	49275.36	110399.94	16995.56	25324.26	16999.36	500.00	221052.63
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
2,4,6-Trichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pentachlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	14	269.61	664.02	1766.40	4662.72	8849.63	1753.06	3577.08	1755.02	90.91	37692.31
Dieldrin	4	55.56	55.56	494.11	4333.33	4333.33	490.65	2138.89	494.11	55.56	4333.33

Table A4.2 Summary of the whole-sediment chemistry data for surficial sediments in the Grand Calumet River Lagoons.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	16	287.26	3993.64	7133.92	14270.19	59664.11	6705.62	87167.25	6710.74	176.92	1007692.30
p,p'-DDE	22	630.37	1784.68	30958.37	64989.60	77766.90	13189.45	42712.66	13195.17	300.00	1026923.07
p,p'-DDT	23	37.15	179.35	2800.00	11507.13	17277.64	NC	37340.28	1402.32	0.00	757692.31
Endosulfan, total	5	171.67	183.46	192.27	228.28	393.47	237.00	98.55	237.08	164.23	565.38
Endrin	22	44.06	60.40	87.04	200.00	247.59	113.79	131.40	114.26	19.69	2333.33
Heptachlor	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Heptachlor epoxide	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

NC = Not calculated (i.e., a Geomean can not be calculated if one or more of the values equal zero); OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p* -dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p* -dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).
[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.
[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.
[4]The geometric mean was not calculated using the $\log_e$ transformed data.
[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).
Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Table A4.3 Summary of the whole-sediment chemistry data for surficial sediments in the Indiana Harbor and nearshore areas of Lake Michigan.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Carbazole	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	10	39222.04	50296.36	69221.87	79498.71	100897.45	63626.02	13538.89	63626.17	21481.48	166666.67
Benzo(a)pyrene	10	22636.38	28474.17	64043.44	108815.23	131513.84	57498.18	24626.02	57498.45	20370.37	138888.89
Benzo(b)fluoranthene	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Benzo(k)fluoranthene	10	8172.31	11136.04	25445.25	44330.00	78778.39	24627.17	23203.66	24627.62	6470.59	130718.95
Chrysene	10	46617.02	61990.63	78400.09	98399.48	118053.13	77256.58	23503.63	77256.69	33333.33	183333.33
Dibenz[a,h]anthracene	6	5332.44	5509.78	8038.35	12258.73	17280.42	9047.89	3980.76	9048.04	5185.19	23888.89
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	10	13423.81	18697.79	47165.77	83530.59	94542.03	40131.82	19561.00	40132.19	12352.94	95424.84
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.3 Summary of the whole-sediment chemistry data for surficial sediments in the Indiana Harbor and nearshore areas of Lake Michigan.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	2	58195.85	66598.84	83385.57	104403.45	119478.32	83385.47	38763.73	83385.57	53191.49	130718.95
Aroclor 1248	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1254	1	17730.50	17730.50	17730.50	17730.50	17730.50	17730.50	NA	17730.50	17730.50	17730.50
Aroclor 1260	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Total PCBs	30	10894.66	23664.95	72852.86	123338.89	267757.48	52389.30	56649.89	52392.55	693.80	500000.00
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
2,4,6-Trichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pentachlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	1	862.75	862.75	862.75	862.75	862.75	862.75	NA	862.75	862.75	862.75
Dieldrin	2	3660.13	3660.13	3660.13	3660.13	3660.13	3660.13	NA	3660.13	3660.13	3660.13

Table A4.3 Summary of the whole-sediment chemistry data for surficial sediments in the Indiana Harbor and nearshore areas of Lake Michigan.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
p,p'-DDE	1	640.52	640.52	640.52	640.52	640.52	640.52	NA	640.52	640.52	640.52
p,p'-DDT	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Endosulfan, total	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Endrin	1	235.29	235.29	235.29	235.29	235.29	235.29	NA	235.29	235.29	235.29
Heptachlor	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Heptachlor epoxide	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	2	0.68	0.97	1.56	2.33	2.90	1.30	1.41	1.56	0.51	3.34

OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p*-dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).
[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.
[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.
[4]The geometric mean was not calculated using the $\log_e$ transformed data.
[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).
Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Table A4.4 Summary of the whole-sediment chemistry data for surficial sediments in the Assessment Area.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	79	70.35	326.69	1070.05	19621.63	345289.67	2834.59	320186.52	2847.08	17.52	7586956.68
Carbazole	5	51079.36	54187.19	62135.92	96000.00	108456.89	71490.33	23321.14	71490.38	49107.14	117647.05
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	364	13000.00	43316.18	148064.44	461766.78	1405380.23	154174.62	807734.45	154177.72	1044.03	45080439.62
Benzo(a)pyrene	361	17000.00	41935.48	130718.95	390000.01	1122448.96	140638.44	560938.86	140640.72	1153.85	16695652.52
Benzo(b)fluoranthene	85	21382.10	60377.36	135416.66	369863.00	1060590.95	155741.29	545744.39	155743.32	3071.43	15454545.12
Benzo(k)fluoranthene	176	12513.74	28964.93	73316.26	301379.35	1291069.40	100530.80	576286.87	100533.09	2142.86	12260869.82
Chrysene	381	17000.00	42000.00	166666.66	588376.64	1775700.97	167973.17	706200.34	167976.08	1153.85	25478261.40
Dibenz[a,h]anthracene	138	7807.65	13308.50	30114.08	93724.54	333073.77	38961.75	96043.84	38963.08	1285.71	2147058.76
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	163	17271.47	33911.65	76666.67	254337.37	1214904.04	105716.95	475983.54	105718.61	2944.44	14695652.48
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.4 Summary of the whole-sediment chemistry data for surficial sediments in the Assessment Area.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	15	25717.65	55524.19	130718.95	163770.57	347442.14	97065.85	47397.76	97066.58	11538.46	526315.78
Aroclor 1248	147	4385.64	21236.30	63636.36	197855.96	665713.94	59444.10	193203.62	59449.57	500.00	4170731.80
Aroclor 1254	21	1152.78	8426.97	35026.02	159615.39	221052.63	23821.44	81326.97	23834.10	116.79	539823.01
Aroclor 1260	20	2485.65	3159.28	11401.76	22107.82	30945.05	9592.55	8662.24	9593.15	2112.68	49275.36
Total PCBs	213	2850.31	18055.56	63636.36	176190.48	463269.35	50404.90	154270.48	50417.73	44.17	4170731.80
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	14	13218.60	15174.99	20675.50	23647.59	33099.21	20817.73	5090.01	20817.81	12500.00	63333.33
2,4,6-Trichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pentachlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	42	433.68	702.95	1331.06	6188.01	11514.37	1935.56	3761.73	1936.76	90.91	37692.31
Dieldrin	46	179.37	320.00	1135.14	4304.13	10000.00	1277.21	2538.65	1279.18	55.56	17272.73

Table A4.4 Summary of the whole-sediment chemistry data for surficial sediments in the Assessment Area.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	29	169.40	481.66	1818.18	7500.00	19339.71	2157.11	46963.21	2161.18	53.19	1007692.30
p,p'-DDE	55	560.55	795.66	5057.47	27146.35	64586.72	5436.19	27361.58	5439.67	95.00	1026923.07
p,p'-DDT	47	53.52	246.73	1100.00	6523.78	14888.39	NC	15362.20	1067.93	0.00	757692.31
Endosulfan, total	100	205.26	558.85	1643.07	3181.16	7918.18	1426.24	1671.65	1427.34	106.54	16093.75
Endrin	78	57.26	78.53	183.64	224.11	250.00	149.64	76.66	149.98	19.69	2333.33
Heptachlor	17	524.53	863.56	2880.00	8671.33	9409.37	2569.59	4155.00	2570.53	336.13	36944.45
Heptachlor epoxide	12	607.97	834.89	2190.52	3179.44	3912.65	1949.00	1781.18	1949.62	352.94	25733.33
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	6	521.80	737.28	1471.10	1794.96	3304.64	1363.79	802.91	1364.14	453.78	5833.33
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	14	377.97	1177.34	2201.53	4664.35	14976.10	2325.39	4018.66	2326.95	153.47	25416.67
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	17	0.00002	0.00002	0.00005	1.45	3.23	0.002	1.75	0.56	0.000003	6.20

NC = Not calculated (i.e., a Geomean can not be calculated if one or more of the values equal zero); OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p*-dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).
[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.
[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.
[4]The geometric mean was not calculated using the $\log_e$ transformed data.
[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).
Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Table A4.5 Summary of the whole-sediment chemistry data for sub-surface sediments in the Grand Calumet River/Indiana Harbor Canal.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	64	104.30	272.18	837.58	22923.41	610215.12	3041.01	785333.03	3049.19	55.78	11583332.87
Carbazole	10	1856.12	1941.58	3191.42	212496.94	1395905.76	21312.32	677422.42	21317.44	1470.59	4374999.93
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	120	10377.38	86704.08	218739.35	697510.22	3253622.37	212806.78	2038019.99	212824.96	241.18	50833331.31
Benzo(a)pyrene	111	16875.00	66666.67	157894.74	376939.43	3092783.41	161509.20	1708472.01	161520.45	223.53	52499997.91
Benzo(b)fluoranthene	43	3061.00	14838.62	60416.66	216465.11	1955571.31	71999.17	1521515.30	72010.34	382.35	29687499.56
Benzo(k)fluoranthene	92	6238.11	38114.50	93284.57	238257.26	2858484.17	97878.25	1316718.05	97900.05	120.59	44166664.91
Chrysene	127	8936.65	82746.60	244897.95	629757.25	3170483.73	230566.92	1859328.03	230584.10	205.88	43749999.35
Dibenz[a,h]anthracene	52	5325.11	10227.61	23646.52	140801.35	608343.25	38932.83	244259.13	38936.00	651.52	3437499.95
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	83	18126.27	42377.55	93750.00	275412.64	1671979.21	127570.91	1197525.67	127576.96	600.00	29166665.51
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.5 Summary of the whole-sediment chemistry data for sub-surface sediments in the Grand Calumet River/Indiana Harbor Canal.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1248	52	5526.73	27799.97	123027.41	432657.16	829828.04	97344.00	577495.29	97352.55	407.69	12682926.94
Aroclor 1254	3	32830.13	71126.36	258000.00	412128.72	545859.25	149336.21	181360.17	149338.02	19607.84	658333.31
Aroclor 1260	2	2262.89	2723.39	3708.30	5049.26	6076.53	3708.10	2437.50	3708.30	2000.00	6875.00
Total PCBs	52	5526.73	28018.40	123027.41	432657.16	829828.04	98707.44	596099.22	98716.11	407.69	12682926.94
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	1	13750.00	13750.00	13750.00	13750.00	13750.00	13750.00	NA	13750.00	13750.00	13750.00
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	17	3701.99	6388.89	18000.00	36885.25	53852.43	15928.22	14767.94	15928.93	3088.24	114285.72
2,4,6-Trichlorophenol	4	3257.79	3529.72	3700.06	3780.22	3910.60	3606.18	201.07	3606.18	3088.24	4000.00
Pentachlorophenol	1	48.00	48.00	48.00	48.00	48.00	48.00	NA	48.00	48.00	48.00
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	9	155.94	1018.75	2181.82	3284.31	8008.83	1684.98	3343.87	1686.98	145.24	24070.80
Dieldrin	34	79.56	136.00	179.05	215.24	300.21	174.95	46.87	175.09	66.06	625.00

Table A4.5 Summary of the whole-sediment chemistry data for sub-surface sediments in the Grand Calumet River/Indiana Harbor Canal.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	20	307.30	423.65	686.65	1163.49	1868.30	666.75	395.02	667.45	50.00	2650.08
p,p'-DDE	18	216.73	267.94	367.56	528.20	1200.92	467.01	757.67	467.35	134.23	8141.59
p,p'-DDT	2	78.20	127.87	289.07	651.94	1061.42	287.43	706.25	289.07	56.25	1468.75
Endosulfan, total	56	164.14	300.68	1220.40	2664.67	7042.29	1056.67	1598.53	1058.00	98.93	14471.31
Endrin	46	14.85	16.96	50.00	119.46	204.30	52.06	110.11	52.67	12.62	4336.28
Heptachlor	1	73.81	73.81	73.81	73.81	73.81	73.81	NA	73.81	73.81	73.81
Heptachlor epoxide	4	65.07	70.06	85.27	113.47	143.45	93.21	25.59	93.28	61.94	167.68
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	3	1351.72	1452.15	1636.36	4662.01	8736.34	3036.62	4990.93	3037.10	1288.66	13278.69
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	2	72.78	120.96	280.86	650.40	1075.80	279.08	726.33	280.86	51.77	1504.42
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p* -dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p* -dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).

[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.

[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.

[4]The geometric mean was not calculated using the $\log_e$ transformed data.

[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).

Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Table A4.6 Summary of the whole-sediment chemistry data for sub-surface sediments in the Grand Calumet River Lagoons.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Carbazole	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	1	1533724.41	1533724.41	1533724.41	1533724.41	1533724.41	1533724.41	NA	1533724.41	1533724.41	1533724.41
Benzo(a)pyrene	1	1302052.84	1302052.84	1302052.84	1302052.84	1302052.84	1302052.84	NA	1302052.84	1302052.84	1302052.84
Benzo(b)fluoranthene	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Benzo(k)fluoranthene	2	27625.01	46196.38	108837.56	256416.81	428791.74	108835.69	292248.88	108837.56	19607.84	604105.60
Chrysene	1	1328445.81	1328445.81	1328445.81	1328445.81	1328445.81	1328445.81	NA	1328445.81	1328445.81	1328445.81
Dibenz[a,h]anthracene	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	1	648093.87	648093.87	648093.87	648093.87	648093.87	648093.87	NA	648093.87	648093.87	648093.87
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.6 Summary of the whole-sediment chemistry data for sub-surface sediments in the Grand Calumet River Lagoons.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1248	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1254	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1260	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Total PCBs	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
2,4,6-Trichlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pentachlorophenol	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Dieldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

Table A4.6 Summary of the whole-sediment chemistry data for sub-surface sediments in the Grand Calumet River Lagoons.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
p,p'-DDE	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
p,p'-DDT	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Endosulfan, total	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Endrin	1	49.04	49.04	49.04	49.04	49.04	49.04	NA	49.04	49.04	49.04
Heptachlor	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Heptachlor epoxide	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p*-dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).
[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.
[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.
[4]The geometric mean was not calculated using the $\log_e$ transformed data.
[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).
Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Table A4.7 Summary of the whole-sediment chemistry data for sub-surface sediments in the Assessment Area.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Metals (mg/kg OC)											
Mercury	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Polycyclic Aromatic Hydrocarbons (PAHs; µg/kg OC)											
Acenapthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Acenaphthylene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Anthracene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benzene	64	104.30	272.18	837.58	22923.41	610215.12	3041.01	785333.03	3049.19	55.78	11583332.87
Carbazole	10	1856.12	1941.58	3191.42	212496.94	1395905.76	21312.32	677422.42	21317.44	1470.59	4374999.93
Fluorene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
2-Methylnaphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Naphthalene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Phenanthrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Benz[a]anthracene	121	10384.62	87234.05	224218.75	708333.31	3142857.20	216308.91	2013119.35	216327.24	241.18	50833331.31
Benzo(a)pyrene	112	17029.82	68493.49	159375.21	390078.31	2865030.60	164547.17	1683796.98	164558.54	223.53	52499997.91
Benzo(b)fluoranthene	43	3061.00	14838.62	60416.66	216465.11	1955571.31	71999.17	1521515.30	72010.34	382.35	29687499.56
Benzo(k)fluoranthene	94	6570.16	37802.23	93284.57	245547.18	2373054.65	98099.49	1279452.82	98120.90	120.59	44166664.91
Chrysene	128	9022.67	85821.65	251272.27	675187.03	3167859.54	233743.09	1840309.39	233760.38	205.88	43749999.35
Dibenz[a,h]anthracene	52	5325.11	10227.61	23646.52	140801.35	608343.25	38932.83	244259.13	38936.00	651.52	3437499.95
Fluoranthene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Indeno(1,2,3-cd)pyrene	84	18659.40	43312.40	94964.96	288262.23	1647722.74	130063.39	1180012.40	130069.49	600.00	29166665.51
Pyrene	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
Total PAHs	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG

Table A4.7 Summary of the whole-sediment chemistry data for sub-surface sediments in the Assessment Area.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Polychlorinated Biphenyls (PCBs; µg/kg OC)											
Aroclor 1016	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1242	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aroclor 1248	52	5526.73	27799.97	123027.41	432657.16	829828.04	97344.00	577495.29	97352.55	407.69	12682926.94
Aroclor 1254	3	32830.13	71126.36	258000.00	412128.72	545859.25	149336.21	181360.17	149338.02	19607.84	658333.31
Aroclor 1260	2	2262.89	2723.39	3708.30	5049.26	6076.53	3708.10	2437.50	3708.30	2000.00	6875.00
Total PCBs	52	5526.73	28018.40	123027.41	432657.16	829828.04	98707.44	596099.22	98716.11	407.69	12682926.94
Chlorinated Benzenes (µg/kg OC)											
Hexachlorobenzene (HCB)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hexachlorobutadiene (HCBD)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Phthalates (µg/kg OC)											
Bis(2-ethylhexyl)phthalate	1	13750.00	13750.00	13750.00	13750.00	13750.00	13750.00	NA	13750.00	13750.00	13750.00
Chlorophenols (µg/kg OC)											
2,4-Dichlorophenol	17	3701.99	6388.89	18000.00	36885.25	53852.43	15928.22	14767.94	15928.93	3088.24	114285.72
2,4,6-Trichlorophenol	4	3257.79	3529.72	3700.06	3780.22	3910.60	3606.18	201.07	3606.18	3088.24	4000.00
Pentachlorophenol	1	48.00	48.00	48.00	48.00	48.00	48.00	NA	48.00	48.00	48.00
Pesticides (µg/kg OC)											
Aldrin	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Chlordane	9	155.94	1018.75	2181.82	3284.31	8008.83	1684.98	3343.87	1686.98	145.24	24070.80
Dieldrin	34	79.56	136.00	179.05	215.24	300.21	174.95	46.87	175.09	66.06	625.00

Table A4.7 Summary of the whole-sediment chemistry data for sub-surface sediments in the Assessment Area.

Chemicals of Potential Concern (COPCs)	Number of samples (n)[1]	10th Percentile[2,3]	25th Percentile[2,3]	50th Percentile[2,3]	75th Percentile[2,3]	90th Percentile[2,3]	Geomean Mean[2,4]	Geometric Standard Deviation[2,5]	Arithmetic Mean[2,3]	Minimum[2]	Maximum[2]
Pesticides (µg/kg OC; cont.)											
p,p'-DDD	20	307.30	423.65	686.65	1163.49	1868.30	666.75	395.02	667.45	50.00	2650.08
p,p'-DDE	18	216.73	267.94	367.56	528.20	1200.92	467.01	757.67	467.35	134.23	8141.59
p,p'-DDT	2	78.20	127.87	289.07	651.94	1061.42	287.43	706.25	289.07	56.25	1468.75
Endosulfan, total	56	164.14	300.68	1220.40	2664.67	7042.29	1056.67	1598.53	1058.00	98.93	14471.31
Endrin	47	14.86	16.97	50.00	116.76	204.10	52.00	107.94	52.59	12.62	4336.28
Heptachlor	1	73.81	73.81	73.81	73.81	73.81	73.81	NA	73.81	73.81	73.81
Heptachlor epoxide	4	65.07	70.06	85.27	113.47	143.45	93.21	25.59	93.28	61.94	167.68
Alpha-hexachlorocyclohexane (HCH)	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Beta-HCH	3	1351.72	1452.15	1636.36	4662.01	8736.34	3036.62	4990.93	3037.10	1288.66	13278.69
Technical-HCH	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lindane (gamma-HCH)	2	72.78	120.96	280.86	650.40	1075.80	279.08	726.33	280.86	51.77	1504.42
PCDDs and PCDFs (µg/kg OC)											
TCDD-TEQ	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

OC = organic carbon; TCDD-TEQ = tetrachlorodibenzo-*p*-dioxin - toxic equivalents; PCDDs = polychlorinated dibenzo-*p*-dioxins; PCDFs = polychlorinated dibenzofurans; NM = not measured; NG = no guideline.

[1]Excluding results for which the detection limit was greater than the selected chemical benchmark (see Section 3.2 for details).
[2]If the result is less than the detection limit, the value of 1/2 the detection limit was assigned.
[3]The percentiles and arithmetic mean were calculated using $\log_e$ transformed data.
[4]The geometric mean was not calculated using the $\log_e$ transformed data.
[5]The geometric standard deviation was calculated using the methods outlined in Gilbert (1987).
Note: Substances not listed in this table were not used in the analysis or not measured in this geographic area.

Appendix 5

Tissue Residue Data Tables

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**Q-CARP-1**	**Q-CARP-2**	**Q-CARP-3**	**Q-CARP-4**	**Q-CARP-5**	**Q-CARP-6**	**R-CARP-1**	**R-CARP-2**	**R-CARP-3**	**A** **RO3499**	**B** **RO3502**
Reference	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	IDEM 2000b	IDEM 2000b
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	IH/LM	IH/LM	IH/LM	GCRL	GCRL
Year	1988	1988	1988	1988	1988	1988	1988	1988	1988	1997	1997
Lab Tissue Type[1]	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	SK-OFF	SK-OFF
Number Fish/Sample	1	1	1	1	1	1	1	1	1	5	5
Length (cm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Weight (gm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	1390	2072
Latitude	41.645679	41.645679	41.645679	41.645679	41.645679	41.645679	41.667786	41.667786	41.667786	NR	NR
Longitude	-87.472031	-87.472031	-87.472031	-87.472031	-87.472031	-87.472031	-87.439423	-87.439423	-87.439423	NR	NR
Conventionals (%)											
Percent Lipid	8.13	31.57	0.71	16.16	1.68	32.14	11.32	11.35	9.34	2.92	2.96
Percent Moisture	72.57	64.84	70.11	73.45	81.71	83.64	67.76	69.28	67.71	NR	NR
Metals (mg/kg)											
Mercury	0.0584	0.0487	0.0573	0.0634	<0.00714	0.0160	0.0864	0.112	*0.193*	0.105	0.075
Pesticides (µg/kg)											
Aldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Aldrin + Dieldrin[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
2,4'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4,4'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	79	68
Sum DDD[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC	NC
2,4'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4,4'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sum DDE[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	Q-CARP-1	Q-CARP-2	Q-CARP-3	Q-CARP-4	Q-CARP-5	Q-CARP-6	R-CARP-1	R-CARP-2	R-CARP-3	A RO3499	B RO3502
Pesticides (µg/kg; cont.)											
2,4'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4,4'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sum DDT[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Total DDT[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC	NC
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor + Heptachlor epoxide[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Alpha (Cis) Chlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	24	25
Cis-Nonachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	11	NR
Gamma (Trans) Chlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	8.3	8.7
Oxychlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Trans-Nonachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Total Chlordane (all isomers)[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	24	25
Polychlorinated Biphenyls (µg/kg)											
Total PCBs (reported)	*1350*	***5830***	*336*	*1200*	*875*	*148*	***3210***	*469*	*727*	*410*	*340*

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**C** **RO3505**	**D** **RO3508**	**E** **RO3511**	**F** **RO3514**	**G** **RO3517**	**H** **RO3520**	**I** **RO3523**	**J** **RO3526**	**K** **RO3529**	**L** **RO3532**
Reference	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL
Year	1997	1997	1997	1997	1997	1997	1997	1997	1997	1997
Lab Tissue Type[1]	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF
Number Fish/Sample	5	5	5	5	5	5	5	5	5	5
Length (cm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Weight (gm)	2097	2089	1192	1390	738	1135	624	880	1419	679
Latitude	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Longitude	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Conventionals (%)										
Percent Lipid	2.74	2.45	1.34	1.22	1.38	1.46	1.39	0.71	0.9	1.14
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Metals (mg/kg)										
Mercury	NR	0.115	NR	0.075	0.075	NR	NR	0.11	<u>*0.245*</u>	0.085
Pesticides (µg/kg)										
Aldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Aldrin + Dieldrin[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
2,4'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4,4'-DDD	51	48	NR	11	36	32	NR	NR	NR	NR
Sum DDD[2]	NC	NC	NR	NC	NC	NC	NR	NR	NR	NR
2,4'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4,4'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sum DDE[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	C RO3505	D RO3508	E RO3511	F RO3514	G RO3517	H RO3520	I RO3523	J RO3526	K RO3529	L RO3532
Pesticides (µg/kg; cont.)										
2,4'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4,4'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Sum DDT[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Total DDT[2]	NC	NC	NR	NC	NC	NC	NR	NR	NR	NR
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Heptachlor + Heptachlor epoxide[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Alpha (Cis) Chlordane	23	18	NR	NR	13	11	NR	NR	NR	NR
Cis-Nonachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Gamma (Trans) Chlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Oxychlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Trans-Nonachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Total Chlordane (all isomers)[2]	23	NC	NR	NR	NC	NC	NR	NR	NR	NR
Polychlorinated Biphenyls (µg/kg)										
Total PCBs (reported)	*280*	*290*	*270*	*160*	*300*	*210*	*70*	*320*	*240*	*240*

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversic factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**M** **RO3535**	**N** **RO3538**	**O** **RO3541**	**P** **RO3544**	**Q** **RO3547**	**R** **RO3610**	**00658**	**00478**	**00477**	**00199**
Reference	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000b	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCRL	GCRL	GCRL	GCRL	GCRL	GCRL	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1997	1997	1997	1997	1997	1997	1980	1982	1982	1984
Lab Tissue Type[1]	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	SK-OFF	WHOLE	WHOLE	WHOLE	WHOLE
Number Fish/Sample	5	5	5	5	5	5	5	3	3	5
Length (cm)	NR	NR	NR	NR	NR	NR	11.6 - 26.8	35 - 55.5	48.5 - 63	48.7 - 53.5
Weight (gm)	653	822	993	968	1646	1277	22 - 280	624 - 1276	1588 - 2863	1844 - 2298
Latitude	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Longitude	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Conventionals (%)										
Percent Lipid	1.07	2.05	0.76	0.78	1.13	0.74	1.74	8.82	8.03	7.35
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Metals (mg/kg)										
Mercury	0.08	0.06	0.145	0.11	*0.17*	*0.2*	<0.0357	NR	NR	<0.0200
Pesticides (µg/kg)										
Aldrin	NR	NR	NR	NR	NR	NR	<23.7	<23.7	<23.7	<23.7
Dieldrin	NR	NR	NR	NR	NR	NR	0.741	<7.41	<7.41	7.41
Aldrin + Dieldrin[2]	NR	NR	NR	NR	NR	NR	NC	NC	NC	NC
2,4'-DDD	NR	NR	NR	NR	NR	NR	<7.41	<7.41	<7.41	<7.41
4,4'-DDD	NR	NR	NR	NR	NR	NR	6.67	127	140	48.9
Sum DDD[2]	NR	NR	NR	NR	NR	NR	NC	NC	NC	NC
2,4'-DDE	NR	NR	NR	NR	NR	NR	<7.41	<7.41	<7.41	<7.41
4,4'-DDE	NR	NR	NR	NR	NR	NR	8.15	239	960	112
Sum DDE[2]	NR	NR	NR	NR	NR	NR	NC	239	960	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	M RO3535	N RO3538	O RO3541	P RO3544	Q RO3547	R RO3610	00658	00478	00477	00199
Pesticides (µg/kg; cont.)										
2,4'-DDT	NR	NR	NR	NR	NR	NR	<7.41	<7.41	<7.41	<7.41
4,4'-DDT	NR	NR	NR	NR	NR	NR	<7.41	<7.41	<7.41	<7.41
Sum DDT[2]	NR	NR	NR	NR	NR	NR	NC	NC	NC	NC
Total DDT[2]	NR	NR	NR	NR	NR	NR	NC	239	960	NC
Heptachlor	NR	NR	NR	NR	NR	NR	<23.7	<23.7	<23.7	<23.7
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	<5.93	<5.93	<5.93	7.41
Heptachlor + Heptachlor epoxide[2]	NR	NR	NR	NR	NR	NR	NC	NC	NC	NC
Alpha (Cis) Chlordane	NR	NR	NR	NR	NR	NR	4.44	54.8	48.1	<5.93
Cis-Nonachlor	NR	NR	NR	NR	NR	NR	0.741	<5.93	23.0	10.4
Gamma (Trans) Chlordane	NR	NR	NR	NR	NR	NR	5.93	147	279	6.67
Oxychlordane	NR	NR	NR	NR	NR	NR	0.741	<5.93	0.741	1.48
Trans-Nonachlor	NR	NR	NR	NR	NR	NR	<5.93	19.3	48.1	14.8
Total Chlordane (all isomers)[2]	NR	NR	NR	NR	NR	NR	NC	221	**399**	14.8
Polychlorinated Biphenyls (µg/kg)										
Total PCBs (reported)	*240*	*420*	*370*	*320*	*930*	*660*	*1050*	*3430*	***9260***	***4350***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversio factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	**00881**	**00882**	**80502396**	**80502398**	**80502399**	**80502403**	**80502404**	**80502405**	**80502406**	**80502409**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1986	1986	1986	1986	1986	1986	1986	1987	1987	1987
Lab Tissue Type[1]	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE
Number Fish/Sample	5	5	3	4	4	5	3	4	2	4
Length (cm)	33 - 40	36 - 43	53 - 70	66 - 73.5	36.1 - 67	62 - 68.5	62.4 - 75.6	52 - 65.1	22 - 36.5	28.4 - 37.5
Weight (gm)	610 - 850	790 - 1238	2071 - 4654	3859 - 4937	738 - 4058	2866 - 4370	3093 - 6299	1873 - 4086	190 - 790	380 - 851
Latitude	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Longitude	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Conventionals (%)										
Percent Lipid	5.8	5.48	13.3	14.5	9.3	16.6	13.5	14	5.8	8.3
Percent Moisture	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Metals (mg/kg)										
Mercury	0.0471	0.0471	*0.203*	*0.243*	*0.271*	*0.214*	*0.320*	0.146	0.0743	0.0714
Pesticides (μg/kg)										
Aldrin	NR	NR	<184	19.3	<184	<302	16.3	8.15	11.9	24.4
Dieldrin	5.93	5.93	31.9	93.3	48.1	109	137	52.6	<7.41	17.8
Aldrin + Dieldrin[2]	NC	NC	NC	93.3	NC	109	137	NC	NC	NC
2,4'-DDD	NR	NR	8.15	<7.41	<7.41	<7.41	<7.41	<7.41	<7.41	<7.41
4,4'-DDD	17.8	16.3	78.5	256	110	250	341	158	26.7	22.2
Sum DDD[2]	NC	NC	NC	256	NC	250	341	158	NC	NC
2,4'-DDE	NR	NR	27.4	66.7	28.1	37.8	45.2	18.5	12.6	17.0
4,4'-DDE	<7.41	<0.741	633	889	622	1330	1930	1700	<156	14.1
Sum DDE[2]	NC	NC	633	889	622	1330	1930	1700	NC	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	**00881**	**00882**	**80502396**	**80502398**	**80502399**	**80502403**	**80502404**	**80502405**	**80502406**	**80502409**
Pesticides (µg/kg; cont.)										
2,4'-DDT	NR	NR	<7.41	<7.41	<7.41	<7.41	<7.41	<7.41	<7.41	<7.41
4,4'-DDT	1.48	0.741	11.1	<7.41	<7.41	<7.41	164	<7.41	<7.41	<7.41
Sum DDT[2]	NC	NC	NC	NC	NC	NC	164	NC	NC	NC
Total DDT[2]	NC	NC	633	1140	622	1580	2430	1860	NC	NC
Heptachlor	NR	NR	<184	<184	<184	<302	<599	<302	<124	<184
Heptachlor epoxide	1.48	1.48	<5.93	11.9	<5.93	12.6	17.8	<5.93	<5.93	10.4
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	6.67	7.41	14.1	89.6	40.0	60.7	72.6	31.9	8.15	10.4
Cis-Nonachlor	2.22	2.22	8.15	42.2	14.1	21.5	29.6	23.0	<5.93	<5.93
Gamma (Trans) Chlordane	4.44	5.19	6.59	57.0	28.1	37.8	39.3	16.3	8.15	11.1
Oxychlordane	8.89	9.63	<5.93	14.8	8.89	13.3	20.0	10.4	<5.93	<5.93
Trans-Nonachlor	<0.741	<0.741	10.4	63.7	25.2	32.6	43.7	22.2	<5.93	<5.93
Total Chlordane (all isomers)[2]	NC	NC	NC	267	93.3	153	205	93.3	NC	NC
Polychlorinated Biphenyls (µg/kg)										
Total PCBs (reported)	***2780***	***2320***	***3780***	***4070***	***3780***	***5260***	***7190***	***5930***	***3190***	***3480***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversior factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**80502410**	**90602983** **292-88**	**90602985** **293-88**	**11202139** **093-90**	**11202141** **094-90**	**30301041** **192-92**	**30301043** **193-92**	**30301044** **194-92**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1987	1988	1988	1990	1990	1992	1992	1992
Lab Tissue Type[1]	WHOLE	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	1	3	1	3	2	1	5	4
Length (cm)	38.5	60.5 - 63	74	55.2 - 61.2	40 - 47.5	80	35 - 39.1	52.2 - 55.5
Weight (gm)	888	3119 - 3686	6691	2412 - 3377	965 - 1674	8427	823 - 965	1958 - 2554
Latitude	NR	NR	NR	41.655	41.655	41.6525	41.6525	41.6525
Longitude	NR	NR	NR	-87.45916667	-87.45916667	-87.46333333	-87.46333333	-87.46333333
Conventionals (%)								
Percent Lipid	4.7	6.2	21.68	6.34	3.42	12.1	6.23	8.34
Percent Moisture	NR	NR	NR	74.2	76.5	55.91	73.37	72.4
Metals (mg/kg)								
Mercury	0.0643	0.084	0.124	0.13	0.014	0.09	0.01	0.03
Pesticides (μg/kg)								
Aldrin	<124	<16	<40	205	150	<8	<8	<40
Dieldrin	<7.41	21	210	23	<10	99	<10	<10
Aldrin + Dieldrin[2]	NC	NC	210	205	150	NC	NC	NC
2,4'-DDD	<7.41	<10	<50	26	15	26	<10	10
4,4'-DDD	<7.41	40	61	140	45	78	45	160
Sum DDD[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDE	<7.41	<10	<50	16	<20	<20	<20	<60
4,4'-DDE	<156	145	280	320	64	315	<10	59
Sum DDE[2]	NC	NC	280	320	NC	315	NC	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**80502410**	**90602983** **292-88**	**90602985** **293-88**	**11202139** **093-90**	**11202141** **094-90**	**30301041** **192-92**	**30301043** **193-92**	**30301044** **194-92**
Pesticides (µg/kg; cont.)								
2,4'-DDT	<7.41	<10	<50	<20	<20	<20	<20	<60
4,4'-DDT	<7.41	<10	<50	<20	<20	<20	<20	<60
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	NC	280	320	NC	315	NC	NC
Heptachlor	<124	<16	<40	6.1	8.3	14	9.7	<40
Heptachlor epoxide	<5.93	<8	101	<8	<8	32	<8	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC	101	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	<5.93	<8	80	34	10	27	<16	13
Cis-Nonachlor	<5.93	13	<40	16	<8	11	<8	<8
Gamma (Trans) Chlordane	<5.93	<8	<40	23	<8	13	<8	12
Oxychlordane	<5.93	<8	<40	<8	<8	<8	<8	<8
Trans-Nonachlor	<5.93	<8	<40	18	<16	<16	<16	<48
Total Chlordane (all isomers)[2]	NC	NC	80	57	NC	27	NC	NC
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***2440***	*1600*	***2200***	***5000***	***2500***	***8900***	***4500***	***4600***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**30301045** **195-92**	**40900692** **065-94**	**40900693** **066-94**	**40900694** **067-94**	**41201188** **070-94**	**41201189** **071-94**	**41201191** **073-94**	**41201192** **074-94**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1992	1994	1994	1994	1994	1994	1994	1994
Lab Tissue Type[1]	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	5	1	1	1	2	1	2	2
Length (cm)	22.9 - 28.8	32.8	53.7	49.5	50.6 - 50.7	35.1	35.4 - 39	46 - 46.1
Weight (gm)	216 - 336	624	2100	2724	1844 - 1930	993	530 - 993	1703 - 1703
Latitude	41.6525	41.652222222	41.652222222	41.652222222	41.609027778	41.609027778	41.6125	41.6125
Longitude	-87.46333333	-87.46305556	-87.46305556	-87.46305556	-87.37111111	-87.37111111	-87.43013889	-87.43013889
Conventionals (%)								
Percent Lipid	4.52	2.7	3.46	20.86	5.37	5.99	1.64	5.14
Percent Moisture	72.6	78.2	77.9	62.4	76.5	76.9	80.2	76.3
Metals (mg/kg)								
Mercury	0.01	<0.04	0.05	0.06	<0.02	0.05	0.03	0.02
Pesticides (µg/kg)								
Aldrin	<40	<8	28	8.6	<8	<8	<8	<8
Dieldrin	<10	<10	23	26	<10	<10	<10	<10
Aldrin + Dieldrin[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	<10	<10	19	40	<10	<10	23	16
4,4'-DDD	23	<10	78	290	30	19	120	77
Sum DDD[2]	NC	NC	NC	290	NC	NC	NC	NC
2,4'-DDE	<60	15	20	62	<84	<20	<38	<120
4,4'-DDE	<50	37	53	330	<40	69	23	39
Sum DDE[2]	NC	NC	NC	330	NC	NC	NC	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**30301045** **195-92**	**40900692** **065-94**	**40900693** **066-94**	**40900694** **067-94**	**41201188** **070-94**	**41201189** **071-94**	**41201191** **073-94**	**41201192** **074-94**
Pesticides (µg/kg; cont.)								
2,4'-DDT	<60	<20	<20	13	<20	<20	<20	<20
4,4'-DDT	<60	<20	<20	<20	<10	<20	<10	<10
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	NC	NC	620	NC	NC	NC	NC
Heptachlor	<40	<8	<8	<8	<8	<8	<8	<8
Heptachlor epoxide	<8	<8	<8	11	<8	<8	<8	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	<48	<16	14	55	<8	<8	<8	16
Cis-Nonachlor	<8	<8	<70	<260	<8	<8	<8	<8
Gamma (Trans) Chlordane	<48	<16	<16	41	<8	<8	<8	17
Oxychlordane	<8	<8	<8	<8	<8	<8	<8	<8
Trans-Nonachlor	<48	<16	<16	37	<38	<48	<22	<51
Total Chlordane (all isomers)[2]	NC	NC	NC	133	NC	NC	NC	NC
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***<u>2600</u>***	***<u>3000</u>***	***<u>4900</u>***	***<u>23000</u>***	***<u>6800</u>***	***<u>6600</u>***	*<u>800</u>*	***<u>7950</u>***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**41201194** **075-94**	**41201196** **077-94**	**41201197** **078-94**	**41201198** **079-94**	**41201200** **081-94**	**41201201** **082-94**	**41201202** **083-94**	**61200735** **131-96**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1994	1994	1994	1994	1994	1994	1994	1996
Lab Tissue Type[1]	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	1	3	3	1	3	4	2	1
Length (cm)	78.5	46 - 50.7	41 - 41.8	55.1	40.2 - 42.4	28 - 31.2	60 - 65.4	49.4
Weight (gm)	7037	1816 - 2384	972 - 1163	2696	1050 - 1135	392 - 608	3093 - 4171	1731
Latitude	41.6125	41.614861111	41.614861111	41.614861111	41.615	41.615	41.615	41.609027778
Longitude	-87.43013889	-87.48180556	-87.48180556	-87.48180556	-87.46069444	-87.46069444	-87.46069444	-87.37111111
Conventionals (%)								
Percent Lipid	11.98	8.22	5.03	16.51	4.75	6.64	8.81	9.77
Percent Moisture	69.3	73.8	76.4	66.9	77	77	73.8	71.98
Metals (mg/kg)								
Mercury	0.13	0.02	0.02	0.04	0.03	0.02	0.13	0.0563
Pesticides (µg/kg)								
Aldrin	<8	<8	<8	<8	<8	<8	<8	<8
Dieldrin	21	<10	<10	16	<10	<10	15	26
Aldrin + Dieldrin[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	26	10	<10	20	<10	<10	12	24
4,4'-DDD	200	75	45	160	37	52	97	66
Sum DDD[2]	200	NC	NC	NC	NC	NC	NC	NC
2,4'-DDE	<20	<20	<20	<20	<110	<108	<200	479
4,4'-DDE	1300	34	27	78	29	19	600	300
Sum DDE[2]	1300	NC	NC	NC	NC	NC	600	779

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**41201194** **075-94**	**41201196** **077-94**	**41201197** **078-94**	**41201198** **079-94**	**41201200** **081-94**	**41201201** **082-94**	**41201202** **083-94**	**61200735** **131-96**
Pesticides (µg/kg; cont.)								
2,4'-DDT	<20	<20	<20	<20	<20	<20	<20	<20
4,4'-DDT	<10	<10	<10	<10	<10	<10	<10	15
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	1500	NC	NC	NC	NC	NC	600	779
Heptachlor	<8	<8	<8	<8	<8	<8	<8	110
Heptachlor epoxide	<8	<8	<8	<8	<8	<8	<8	12
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	110
Alpha (Cis) Chlordane	24	18	11	30	<8	<8	27	20
Cis-Nonachlor	25	<8	<8	9	<8	<8	26	<8
Gamma (Trans) Chlordane	<8	18	12	29	<8	11	<8	14
Oxychlordane	<8	<8	<8	<8	<8	<8	<8	<8
Trans-Nonachlor	36	<57	<38	<92	<46	<44	31	15
Total Chlordane (all isomers)[2]	85	NC	NC	59	NC	NC	84	20
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***<u>27000</u>***	***<u>11000</u>***	***<u>5700</u>***	***<u>19000</u>***	***<u>7900</u>***	***<u>6500</u>***	***<u>16000</u>***	***<u>20000</u>***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200736** **133-96**	**61200742** **138-96**	**61200743** **139-96**	**61200744** **140-96**	**61200758** **149-96**	**61200759** **150-96**	**61200761** **152-96**	**61200763** **155-96**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1996	1996	1996	1996	1996	1996	1996	1996
Lab Tissue Type[1]	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	2	1	2	1	1	2	1	3
Length (cm)	35 - 37.7	62.2	42.2 - 42.6	29.9	39.8	28.2 - 28.6	36.4	27.2 - 28.9
Weight (gm)	689 - 789	3093	1305 - 1334	408	993	364 - 392	648	336 - 361
Latitude	41.609027778	41.6125	41.6125	41.6125	41.652222222	41.652222222	41.652222222	41.614861111
Longitude	-87.37111111	-87.43013889	-87.43013889	-87.43013889	-87.46305556	-87.46305556	-87.46305556	-87.48180556
Conventionals (%)								
Percent Lipid	6.06	5.7	7.79	4.7	6.89	4.20	4.04	2.98
Percent Moisture	74.99	74.32	73.53	75.44	74.29	77.16	76.28	77.41
Metals (mg/kg)								
Mercury	0.0256	*<u>0.267</u>*	0.037	0.024	0.0056	<0.006	<0.0058	<0.0055
Pesticides (µg/kg)								
Aldrin	<8	<8	<8	<8	<80	<40	<40	<40
Dieldrin	<10	17	<10	<10	<10	<10	<10	<10
Aldrin + Dieldrin[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	<10	<10	<10	<10	<10	15	<10	<10
4,4'-DDD	33	66	48	20	33	135	24	66
Sum DDD[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDE	198	93	190	110	<170	<91	<130	<90
4,4'-DDE	140	420	170	55	<110	<72	<60	<60
Sum DDE[2]	NC	420	NC	NC	NC	NC	NC	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station	**61200736**	**61200742**	**61200743**	**61200744**	**61200758**	**61200759**	**61200761**	**61200763**
Sample	**133-96**	**138-96**	**139-96**	**140-96**	**149-96**	**150-96**	**152-96**	**155-96**
Pesticides (µg/kg; cont.)								
2,4'-DDT	23	<20	<20	<20	<110	<60	<60	<60
4,4'-DDT	<20	<20	<20	<20	<110	<60	<60	<60
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	420	NC	NC	NC	NC	NC	NC
Heptachlor	39	22	37	26	<80	<40	<40	<40
Heptachlor epoxide	<8	<8	<8	<8	<8	<8	<8	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	10	14	9.4	<8	<8	10	<8	11
Cis-Nonachlor	<18	<8	<8	<8	<8	<8	<8	<8
Gamma (Trans) Chlordane	11	<8	10	<8	<8	6.9	<8	8.8
Oxychlordane	<8	<8	<8	<8	<8	<8	<8	<8
Trans-Nonachlor	8.5	14	8.5	<16	<88	<48	<48	<48
Total Chlordane (all isomers)[2]	NC	NC	NC	NC	NC	NC	NC	NC
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***12500***	***7200***	***13000***	***6700***	***7100***	***2650***	***3500***	***2700***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200764** **156-96**	**61200765** **157-96**	**61200749** **162-96**	**61200750** **163-96**	**61200754** **164-96**	**910262001**	**910262003**	**910262007**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1996	1996	1996	1996	1996	2000	2000	2000
Lab Tissue Type[1]	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	1	1	2	3	2	3	3	3
Length (cm)	36	19.6	24.3 - 25	36.7 - 40.5	42.7 - 46.3	40.5 - 47.5	48.5 - 54.3	40.5 - 41
Weight (gm)	748	150	228 - 272	718 - 985	1305 - 1362	1077 - 1531	1814 - 2381	1106 - 1191
Latitude	41.614861111	41.614861111	41.615	41.615	41.615	41.609166667	41.609166667	41.614444444
Longitude	-87.48180556	-87.48180556	-87.46069444	-87.46069444	-87.46069444	-87.37222222	-87.37222222	-87.46111111
Conventionals (%)								
Percent Lipid	6.89	4.98	2.62	5.36	4.26	4.03	10.8	9.32
Percent Moisture	74.94	74.21	77.78	75.28	75.52	77.05	69.7	72.1
Metals (mg/kg)								
Mercury	0.007	0.0075	0.0345	0.0281	0.0435	<0.05	<0.05	<0.05
Pesticides (µg/kg)								
Aldrin	<40	<100	<8	<8	<8	<2.5	<2.5	<2.5
Dieldrin	<10	<13	<10	<10	<10	<5	8.3	6.5
Aldrin + Dieldrin[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	16	<13	12	<10	21	6.8	24	12
4,4'-DDD	150	38	37	41	110	38	150	58
Sum DDD[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDE	<60	150	52	171	160	<5	<5	<5
4,4'-DDE	<60	<143	30	85	120	43.5	320	<5
Sum DDE[2]	NC	NC	NC	NC	NC	NC	320	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200764** **156-96**	**61200765** **157-96**	**61200749** **162-96**	**61200750** **163-96**	**61200754** **164-96**	**910262001**	**910262003**	**910262007**
Pesticides (µg/kg; cont.)								
2,4'-DDT	<60	<143	<20	<20	<20	<5	<5	<5
4,4'-DDT	<60	<143	<20	<20	<20	<5	<5	<5
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	NC	NC	NC	NC	NC	320	NC
Heptachlor	<40	<100	<8	29	19	<2.5	<2.5	<2.5
Heptachlor epoxide	<8	<10	<8	<8	<8	<2.5	<2.5	<2.5
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	28	<10	<8	9	13	4.25	31	9.2
Cis-Nonachlor	<8	<10	<8	<8	<8	<5	<5	<5
Gamma (Trans) Chlordane	19	<10	<8	9.6	10	3.35	23	9.4
Oxychlordane	<8	<10	<8	<8	<8	<5	<5	<5
Trans-Nonachlor	<48	<110	<16	<16	16	<5	33	5.6
Total Chlordane (all isomers)[2]	28	NC	NC	NC	NC	NC	87	NC
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***<u>3300</u>***	***<u>4100</u>***	***<u>2400</u>***	***<u>9200</u>***	***<u>8800</u>***	***<u>4700</u>***	***<u>9000</u>***	***<u>7400</u>***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**910262012**	**910262013**	**910262019**	**910398006**	**80502397**	**80502401**	**80502402**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCRL	GCRL	GCRL
Year	2000	2000	2000	2000	1986	1986	1986
Lab Tissue Type[1]	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	SK-ON, SC-OFF	WHOLE	WHOLE	WHOLE
Number Fish/Sample	3	3	3	3	5	3	4
Length (cm)	40.1 - 40.5	58.5 - 63.8	45.8 - 52.1	43.6 - 47.5	43.4 - 57	39.9 - 45.5	33 - 45
Weight (gm)	992 - 1134	2863 - 3856	1928 - 1984	1077 - 1729	1078 - 2298	766 - 1277	482 - 1277
Latitude	41.613055556	41.613055556	41.613888889	41.652222222	NR	NR	NR
Longitude	-87.4325	-87.4325	-87.47805556	-87.46305556	NR	NR	NR
Conventionals (%)							
Percent Lipid	9.64	11.7	2.21	6.01	7.6	2.8	4.5
Percent Moisture	73.3	68.8	80.1	75.1	NR	NR	NR
Metals (mg/kg)							
Mercury	<0.05	0.12	<0.05	<0.05	0.0671	0.0500	0.0514
Pesticides (µg/kg)							
Aldrin	<2.5	<2.5	<2.5	<2.5	<11.9	<11.9	<65.2
Dieldrin	8.2	18	<5	<5	<7.41	<7.41	12.6
Aldrin + Dieldrin[2]	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	13	25	5.1	8.2	25.2	<7.41	<7.41
4,4'-DDD	79	140	30	43	336	22.2	15.6
Sum DDD[2]	NC	NC	NC	NC	336	NC	NC
2,4'-DDE	<5	<5	<5	<5	38.5	<7.41	<7.41
4,4'-DDE	160	590	34	73	963	274	133
Sum DDE[2]	NC	590	NC	NC	963	274	NC

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	910262012	910262013	910262019	910398006	80502397	80502401	80502402
Pesticides (µg/kg; cont.)							
2,4'-DDT	<5	<5	<5	<5	<7.41	<7.41	<7.41
4,4'-DDT	<5	<5	<5	<5	8.89	<7.41	<7.41
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	590	NC	NC	1300	274	NC
Heptachlor	<2.5	<2.5	<2.5	<2.5	<11.9	<11.9	<65.2
Heptachlor epoxide	<2.5	<2.5	<2.5	<2.5	<5.93	<5.93	<5.93
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	16	18	7	7	79.3	8.89	<5.93
Cis-Nonachlor	6.1	13	<5	<5	16.3	<5.93	<5.93
Gamma (Trans) Chlordane	11	11	6.5	4.9	38.5	<5.93	<5.93
Oxychlordane	<5	<5	<5	<5	<5.93	<5.93	<5.93
Trans-Nonachlor	<5	<5	<5	8.6	14.8	<5.93	<5.93
Total Chlordane (all isomers)[2]	NC	NC	NC	NC	149	NC	NC
Polychlorinated Biphenyls (µg/kg)							
Total PCBs (reported)	***<u>10000</u>***	***<u>11000</u>***	***<u>2200</u>***	***<u>4100</u>***	*<u>237</u>*	*<u>215</u>*	*<u>815</u>*

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**90603017** **306-88**	**90603019** **308-88**	**980431004** **212-96**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	IH/LM	IH/LM	IH/LM
Year	1988	1988	1996
Lab Tissue Type[1]	SK-ON, SC-ON	SK-ON, SC-ON, LS	SK-ON, SC-OFF
Number Fish/Sample	2	5	2
Length (cm)	NR	NR	60 - 63.1
Weight (gm)	NR	NR	3360 - 3810
Latitude	NR	NR	41.670277778
Longitude	NR	NR	-87.43666667
Conventionals (%)			
Percent Lipid	20.91	19.95	14.21
Percent Moisture	NR	NR	69.6
Metals (mg/kg)			
Mercury	<u>*0.165*</u>	<u>*0.165*</u>	<0.04
Pesticides (µg/kg)			
Aldrin	<16	<8	<8
Dieldrin	85	102	21
Aldrin + Dieldrin[2]	NC	102	NC
2,4'-DDD	<10	<10	<10
4,4'-DDD	110	210	45
Sum DDD[2]	NC	210	NC
2,4'-DDE	<10	<10	<20
4,4'-DDE	1200	<10	230
Sum DDE[2]	1200	NC	230

Table A5.1 Tissue chemistry data used to assess injury to human uses of fishery resources (carp; *Cyprinus carpio*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**90603017** **306-88**	**90603019** **308-88**	**980431004** **212-96**
Pesticides (µg/kg; cont.)			
2,4'-DDT	14	<10	<20
4,4'-DDT	<10	<10	24
Sum DDT[2]	NC	NC	NC
Total DDT[2]	1200	210	230
Heptachlor	<16	<8	<31
Heptachlor epoxide	19	27	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC
Alpha (Cis) Chlordane	57	85	14
Cis-Nonachlor	25	41	11
Gamma (Trans) Chlordane	34	57	8.3
Oxychlordane	11	<8	<8
Trans-Nonachlor	41	30	<16
Total Chlordane (all isomers)[2]	157	213	NC
Polychlorinated Biphenyls (µg/kg)			
Total PCBs (reported)	*1500*	***3300***	***4200***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; GCRL = Grand Calumet River Lagoons; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-OFF = Skin-off Fillets; SK-ON, SC-OFF = Skin-on fillets, scaleless; SK-ON, SC-ON = Skin-on fillets, scales on; SK-ON, SC-ON, LS = Skin-on fillets, scales on, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.2 Tissue chemistry data used to assess injury to human uses of fishery resources (goldfish; *Carassius auratus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**11202142** **095-90**	**41201190** **072-94**	**41201195** **076-94**	**41201199** **080-94**	**41201203** **084-94**	**61200738** **134-96**	**61200745** **141-96**	**61200755** **146-96**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1990	1994	1994	1994	1994	1996	1996	1996
Lab Tissue Type[1]	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE
Number Fish/Sample	6	8	8	9	10	5	1	5
Length (cm)	15.1 - 23.5	14.7 - 17.5	13.9 - 17.2	18.5 - 19.5	12.5 - 14.8	13.3 - 15.1	12.5	15.5 - 16.2
Weight (gm)	70 - 263	55 - 100	53 - 90	113 - 162	20 - 60	42 - 64	44	76 - 100
Latitude	41.655	41.609027778	41.6125	41.614861111	41.615	41.609027778	41.6125	41.652222222
Longitude	-87.45916667	-87.37111111	-87.43013889	-87.48180556	-87.46069444	-87.37111111	-87.43013889	-87.46305556
Conventionals (%)								
Percent Lipid	4.85	3.92	3.19	4.55	3.44	4.59	4.75	8.86
Percent Moisture	73.6	76.3	76.9	75.3	76.3	72.65	72.31	70.35
Metals (mg/kg)								
Mercury	<0.0143	0.0429	0.0429	0.0429	0.0429	0.0224	0.0419	<0.00786
Pesticides (µg/kg)								
Aldrin	163	<5.93	<5.93	<5.93	<5.93	<5.93	<8.89	<59.3
Dieldrin	<7.41	<7.41	<7.41	<7.41	<7.41	<7.41	<11.1	9.63
Aldrin + Dieldrin[2]	163	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	8.89	<7.41	<7.41	<7.41	<7.41	<7.41	<11.1	8.15
4,4'-DDD	33.3	<7.41	<7.41	88.9	40.0	24.4	<11.1	61.5
Sum DDD[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDE	<14.8	<52.6	<62.2	<43.7	<61.5	126	119	<185
4,4'-DDE	<7.41	<7.41	<57.0	18.5	14.1	81.5	72.6	<81.5
Sum DDE[2]	NC	NC	NC	NC	NC	NC	NC	NC

Table A5.2 Tissue chemistry data used to assess injury to human uses of fishery resources (goldfish; *Carassius auratus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**11202142** **095-90**	**41201190** **072-94**	**41201195** **076-94**	**41201199** **080-94**	**41201203** **084-94**	**61200738** **134-96**	**61200745** **141-96**	**61200755** **146-96**
Pesticides (µg/kg; cont.)								
2,4'-DDT	35.6	<14.8	<14.8	<14.8	<14.8	17.8	<22.2	<81.5
4,4'-DDT	<14.8	<7.41	<7.41	<7.41	<7.41	<14.8	<22.2	<81.5
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Heptachlor	<5.93	<5.93	<5.93	<5.93	<5.93	<5.93	<8.89	<59.3
Heptachlor epoxide	<5.93	<5.93	<5.93	<5.93	<5.93	<5.93	<8.89	<5.93
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	8.89	<5.93	<5.93	11.9	<5.93	8.15	11.9	14.8
Cis-Nonachlor	<5.93	<5.93	<5.93	<5.93	<5.93	<12.6	<8.89	<5.93
Gamma (Trans) Chlordane	<5.93	<5.93	<5.93	10.4	<5.93	5.93	<8.89	10.4
Oxychlordane	<5.93	<5.93	<5.93	<5.93	<5.93	<5.93	<8.89	<5.93
Trans-Nonachlor	<11.9	<28.1	<28.9	<25.2	<31.1	<11.9	<17.8	<65.2
Total Chlordane (all isomers)[2]	NC	NC	NC	NC	NC	NC	NC	14.8
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***<u>4220</u>***	***<u>3040</u>***	***<u>3930</u>***	***<u>2670</u>***	***<u>3850</u>***	***<u>8150</u>***	***<u>6300</u>***	***<u>4960</u>***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000)
[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.2 Tissue chemistry data used to assess injury to human uses of fishery resources (goldfish; *Carassius auratus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200762** **153-96**	**61200748** **161-96**	**910262004**	**910262014**	**910262016**	**910262018**	**910262008**	**910398005**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC	GCR/IHC
Year	1996	1996	2000	2000	2000	2000	2000	2000
Lab Tissue Type[1]	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE
Number Fish/Sample	5	5	12	2	13	41	9	5
Length (cm)	14.2 - 15.5	13 - 13.8	10.9 - 13.7	15 - 20.5	9.1 - 15.9	4.2 - 8.4	10 - 16	7.1 - 20.7
Weight (gm)	60 - 78	40 - 48	24 - 60	64 - 150	14 - 82	1 - 10	18 - 84	4 - 178
Latitude	41.614861111	41.615	41.609166667	41.613055556	41.613888889	41.613888889	41.614444444	41.652222222
Longitude	-87.48180556	-87.46069444	-87.37222222	-87.4325	-87.47805556	-87.47805556	-87.46111111	-87.46305556
Conventionals (%)								
Percent Lipid	4.07	6.61	3.44	3.04	2.67	2.9	4.81	16.6
Percent Moisture	74.35	71.13	74.2	74.4	76.5	79	74.2	64.2
Metals (mg/kg)								
Mercury	<0.00743	0.0487	<0.0714	<0.0714	<0.0714	<0.0714	<0.0714	<0.0714
Pesticides (μg/kg)								
Aldrin	<29.6	<5.93	<1.85	<1.85	<1.85	<1.85	<1.85	<1.85
Dieldrin	<7.41	<7.41	<3.70	<3.70	<3.70	<3.70	<3.70	10.4
Aldrin + Dieldrin[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDD	14.1	<7.41	<3.70	<3.70	<3.70	<3.70	<3.70	10.4
4,4'-DDD	141	25.2	6.67	<3.70	23.0	22.2	11.1	46.7
Sum DDD[2]	NC	NC	NC	NC	NC	NC	NC	NC
2,4'-DDE	<54.1	141	<3.70	<3.70	<3.70	<3.70	<3.70	<3.70
4,4'-DDE	<63.7	81.5	<3.70	31.1	27.4	23.0	<3.70	222
Sum DDE[2]	NC	NC	NC	NC	NC	NC	NC	222

Table A5.2 Tissue chemistry data used to assess injury to human uses of fishery resources (goldfish; *Carassius auratus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200762** **153-96**	**61200748** **161-96**	**910262004**	**910262014**	**910262016**	**910262018**	**910262008**	**910398005**
Pesticides (µg/kg; cont.)								
2,4'-DDT	<44.4	<14.8	<3.70	<3.70	<3.70	<3.70	<3.70	<3.70
4,4'-DDT	<44.4	<14.8	<3.70	<3.70	<3.70	<3.70	<3.70	<3.70
Sum DDT[2]	NC	NC	NC	NC	NC	NC	NC	NC
Total DDT[2]	NC	NC	NC	NC	NC	NC	NC	222
Heptachlor	<29.6	<5.93	<1.85	<1.85	<1.85	<1.85	<1.85	<1.85
Heptachlor epoxide	<5.93	<5.93	<1.85	<1.85	<1.85	<1.85	<1.85	<1.85
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC	NC	NC	NC	NC	NC
Alpha (Cis) Chlordane	20.0	8.89	<1.85	<1.85	4.81	4.22	3.41	17.0
Cis-Nonachlor	6.67	<5.93	<3.70	<3.70	<3.70	<3.70	<3.70	6.81
Gamma (Trans) Chlordane	14.8	7.41	<1.85	<1.85	4.81	4.52	2.30	14.1
Oxychlordane	<5.93	<5.93	<3.70	<3.70	<3.70	<3.70	<3.70	<3.70
Trans-Nonachlor	<35.6	6.22	<3.70	<3.70	<3.70	<3.70	<3.70	32.6
Total Chlordane (all isomers)[2]	34.8	NC	NC	NC	NC	NC	NC	49.6
Polychlorinated Biphenyls (µg/kg)								
Total PCBs (reported)	***2070***	***8150***	***3480***	*2000*	*1110*	*889*	***3930***	***12600***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000)

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.3 Tissue chemistry data used to assess injury to human uses of fishery resources (bluegill; *Lepomis macrochirus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station	**974252003**
Sample	**049-97**
Reference	IDEM 2000a
Geographic Area	GCRL
Year	1997
Lab Tissue Type[1]	WHOLE
Number Fish/Sample	15
Length (cm)	10.4 - 17.2
Weight (gm)	550
Latitude	41.615833333
Longitude	-87.26444444
Conventionals (%)	
Percent Lipid	3.26
Percent Moisture	75.5
Metals (mg/kg)	
Mercury	<0.0571
Pesticides (µg/kg)	
Aldrin	<5.93
Dieldrin	<7.41
Aldrin + Dieldrin[2]	NC
2,4'-DDD	<7.41
4,4'-DDD	14.8
Sum DDD[2]	NC
2,4'-DDE	<14.8
4,4'-DDE	44.4
Sum DDE[2]	NC

Table A5.3 Tissue chemistry data used to assess injury to human uses of fishery resources (bluegill; *Lepomis macrochirus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**974252003** **049-97**
Pesticides (µg/kg; cont.)	
2,4'-DDT	<14.8
4,4'-DDT	<14.8
Sum DDT[2]	NC
Total DDT[2]	NC
Heptachlor	<5.93
Heptachlor epoxide	<5.93
Heptachlor + Heptachlor epoxide[2]	NC
Alpha (Cis) Chlordane	<5.93
Cis-Nonachlor	<5.93
Gamma (Trans) Chlordane	<5.93
Oxychlordane	<5.93
Trans-Nonachlor	<11.9
Total Chlordane (all isomers)[2]	NC
Polychlorinated Biphenyls (µg/kg)	
Total PCBs (reported)	<u>*252*</u>

GCRL = Grand Calumet River Lagoons; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000)
[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.4 Tissue chemistry data used to assess injury to human uses of fishery resources (pumpkinseed; *Lepomis gibbosus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station	**80502408**
Reference	IDEM 2000a
Geographic Area	GCR/IHC
Year	1987
Lab Tissue Type[1]	WHOLE
Number Fish/Sample	10
Length (cm)	7.5 - 10.3
Weight (gm)	10 - 28
Latitude	NR
Longitude	NR
Conventionals (%)	
Percent Lipid	1.5
Metals (mg/kg)	
Mercury	<0.0357

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000)

Table A5.5 Tissue chemistry data used to assess injury to human uses of fishery resources (sunfish; *Lepomis* Hybrid); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station	**Q-SUN-1,2,3**	**R-SUN-1,2,3**
Reference	Risatti and Ross 1989	Risatti and Ross 1989
Geographic Area	GCR/IHC	IH/LM
Year	1988	1988
Lab Tissue Type[1]	WHOLE	WHOLE
Number Fish/Sample	3	3
Length (cm)	NR	NR
Weight (gm)	NR	NR
Latitude	41.645679	41.667786
Longitude	-87.472031	-87.439423
Conventionals (%)		
Percent Lipid	NR	5.1767
Percent Moisture	82.63	78.35
Metals (mg/kg)		
Mercury	0.0443	<0.00714
Polychlorinated Biphenyls (µg/kg)		
Total PCBs (reported)	*<u>380</u>*	*<u>575</u>*

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000).

Table A5.6 Tissue chemistry data used to assess injury to human uses of fishery resources (largemouth bass; *Micropterus salmoides*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**80502400**	**974252001** **047-97**	**974252002** **048-97**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCRL	GCRL	GCRL
Year	1986	1997	1997
Lab Tissue Type[1]	WHOLE	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	1	3	3
Length (cm)	32	39.2 - 43.7	37.1 - 40.3
Weight (gm)	454	809 - 919	582 - 829
Latitude	NR	41.615833333	41.615833333
Longitude	NR	-87.26444444	-87.26444444
Conventionals (%)			
Percent Lipid	4.4	0.62	0.48
Percent Moisture	NR	81	80.8
Metals (mg/kg)			
Mercury	0.0900	<0.04	<0.04
Pesticides (µg/kg)			
Aldrin	<23.7	<8	<8
Dieldrin	<7.41	<10	<10
Aldrin + Dieldrin[2]	NC	NC	NC
2,4'-DDD	<7.41	<10	<10
4,4'-DDD	209	<10	<10
Sum DDD[2]	209	NC	NC
2,4'-DDE	17.0	<10	<20
4,4'-DDE	1040	44	51
Sum DDE[2]	1040	NC	NC

Table A5.6 Tissue chemistry data used to assess injury to human uses of fishery resources (largemouth bass; *Micropterus salmoides*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	80502400	974252001 047-97	974252002 048-97
Pesticides (µg/kg; cont.)			
2,4'-DDT	<7.41	<20	<20
4,4'-DDT	<7.41	<20	<20
Sum DDT[2]	NC	NC	NC
Total DDT[2]	1250	NC	NC
Heptachlor	<23.7	<8	<8
Heptachlor epoxide	<5.93	<8	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC
Alpha (Cis) Chlordane	25.9	<8	<8
Cis-Nonachlor	19.3	<8	<8
Gamma (Trans) Chlordane	11.1	<8	<8
Oxychlordane	15.6	<8	<8
Trans-Nonachlor	22.2	<16	<16
Total Chlordane (all isomers)[2]	83.0	NC	NC
Polychlorinated Biphenyls (µg/kg)			
Total PCBs (reported)	*<u>459</u>*	*<u>170</u>*	*<u>250</u>*

GCRL = Grand Calumet River Lagoons; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; NR = not reported; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-ON, SC-OFF = Skin-on fillets, scaleless.
[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.7 Tissue chemistry data used to assess injury to human uses of fishery resources (longnose sucker; *Catostomus catostomus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**90603018** **307-88**	**90603020** **309-88**
Reference	IDEM 2000a	IDEM 2000a
Geographic Area	IH/LM	IH/LM
Year	1988	1988
Lab Tissue Type[1]	SK-ON, SC-ON	SK-ON, LS
Number Fish/Sample	5	5
Length (cm)	NR	NR
Weight (gm)	NR	NR
Latitude	NR	NR
Longitude	NR	NR
Conventionals (%)		
Percent Lipid	4.78	4
Metals (mg/kg)		
Mercury	0.098	<u>*0.191*</u>
Pesticides (µg/kg)		
Aldrin	<8	<16
Dieldrin	45	49
Aldrin + Dieldrin[2]	NC	NC
2,4'-DDD	<10	<10
4,4'-DDD	34	27
Sum DDD[2]	NC	NC
2,4'-DDE	<10	<10
4,4'-DDE	<10	131
Sum DDE[2]	NC	NC

Table A5.7 Tissue chemistry data used to assess injury to human uses of fishery resources (longnose sucker; *Catostomus catostomus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**90603018** **307-88**	**90603020** **309-88**
Pesticides (µg/kg; cont.)		
2,4'-DDT	<10	<10
4,4'-DDT	<10	24
Sum DDT[2]	NC	NC
Total DDT[2]	NC	NC
Heptachlor	<8	<16
Heptachlor epoxide	17	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC
Alpha (Cis) Chlordane	26	23
Cis-Nonachlor	27	14
Gamma (Trans) Chlordane	14	17
Oxychlordane	<8	17
Trans-Nonachlor	<8	33
Total Chlordane (all isomers)[2]	53	56
Polychlorinated Biphenyls (µg/kg)		
Total PCBs (reported)	*<u>600</u>*	<50

IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; NR = not reported; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels.

[1]Lab Tissue Type: SK-ON, SC-ON = Skin on fillets, scales on; SK-ON, LS = Skin-on fillets, left side.
[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.8 Tissue chemistry data used to assess injury to human uses of fishery resources (white sucker; *Catostomus commersoni*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200766** **158-96**	**910262015**	**910262017**
Reference	IDEM 2000a	IDEM 2000a	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	GCR/IHC
Year	1996	2000	2000
Lab Tissue Type[1]	SK-ON, SC-OFF	WHOLE	WHOLE
Number Fish/Sample	1	1	5
Length (cm)	28.2	22.6	8.6 - 12.5
Weight (gm)	258	100	6 - 20
Latitude	41.614861111	41.613055556	41.613888889
Longitude	-87.48180556	-87.4325	-87.47805556
Conventionals (%)			
Percent Lipid	0.86	1.22	1.57
Percent Moisture	79.75	75.6	78.1
Metals (mg/kg)			
Mercury	0.0123	<0.0714	<0.0714
Pesticides (µg/kg)			
Aldrin	<8	<1.85	<1.85
Dieldrin	<10	<3.70	<3.70
Aldrin + Dieldrin[2]	NC	NC	NC
2,4'-DDD	<10	<3.70	<3.70
4,4'-DDD	18	<3.70	8.15
Sum DDD[2]	NC	NC	NC
2,4'-DDE	<24	<3.70	<3.70
4,4'-DDE	<30	31.9	14.8
Sum DDE[2]	NC	NC	NC

Table A5.8 Tissue chemistry data used to assess injury to human uses of fishery resources (white sucker; *Catostomus commersoni*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**61200766** **158-96**	**910262015**	**910262017**
Pesticides (µg/kg; cont.)			
2,4'-DDT	<20	<3.70	<3.70
4,4'-DDT	<20	<3.70	<3.70
Sum DDT[2]	NC	NC	NC
Total DDT[2]	NC	NC	NC
Heptachlor	<8	<1.85	<1.85
Heptachlor epoxide	<8	<1.85	<1.85
Heptachlor + Heptachlor epoxide[2]	NC	NC	NC
Alpha (Cis) Chlordane	<8	<1.85	2.96
Cis-Nonachlor	<8	<3.70	<3.70
Gamma (Trans) Chlordane	<8	<1.85	3.04
Oxychlordane	<8	<3.70	<3.70
Trans-Nonachlor	<16	<3.70	<3.70
Total Chlordane (all isomers)[2]	NC	NC	NC
Polychlorinated Biphenyls (µg/kg)			
Total PCBs (reported)	<u>*770*</u>	<u>***2150***</u>	<u>*593*</u>

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; COPC = chemical of potential concern; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-ON, SC-OFF = Skin-on fillets, scaleless.
[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.9 Tissue chemistry data used to assess injury to human uses of fishery resources (yellow perch; *Perca flavescens*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group1 threshold.

Station **Sample**	**S-PER-1-10**	**90603021** **315-88**	**90603022** **316-88**
Reference	Risatti and Ross 1989	IDEM 2000a	IDEM 2000a
Geographic Area	IH/LM	IH/LM	IH/LM
Year	1988	1988	1988
Lab Tissue Type[1]	WHOLE	SK-ON, LS	SK-ON, LS
Number Fish/Sample	10	5	5
Length (cm)	NR	20.3 - 22.6	22.4 - 23.9
Weight (gm)	NR	NR	NR
Latitude	41.678841	NR	NR
Longitude	-87.401932	NR	NR
Conventionals (%)			
Percent Lipid	2.87	0.87	0.87
Percent Moisture	74.92	NR	NR
Metals (mg/kg)			
Mercury	0.0326	0.09	0.081
Pesticides (µg/kg)			
Aldrin	NR	<16	<16
Dieldrin	NR	<10	<10
Aldrin + Dieldrin[2]	NR	NC	NC
2,4'-DDD	NR	<10	<10
4,4'-DDD	NR	<10	<10
Sum DDD[2]	NR	NC	NC
2,4'-DDE	NR	<10	<10
4,4'-DDE	NR	<10	<10
Sum DDE[2]	NR	NC	NC

Table A5.9 Tissue chemistry data used to assess injury to human uses of fishery resources (yellow perch; *Perca flavescens*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group1 threshold.

Station	**S-PER-1-10**	**90603021**	**90603022**
Sample		**315-88**	**316-88**
Pesticides (µg/kg; cont.)			
2,4'-DDT	NR	<10	<10
4,4'-DDT	NR	<10	<10
Sum DDT[2]	NR	NC	NC
Total DDT[2]	NR	NC	NC
Heptachlor	NR	<16	<16
Heptachlor epoxide	NR	<8	<8
Heptachlor + Heptachlor epoxide[2]	NR	NC	NC
Alpha (Cis) Chlordane	NR	<8	<8
Cis-Nonachlor	NR	<8	<8
Gamma (Trans) Chlordane	NR	<8	<8
Oxychlordane	NR	<8	<8
Trans-Nonachlor	NR	<8	<8
Total Chlordane (all isomers)[2]	NR	NC	NC
Polychlorinated Biphenyls (µg/kg)			
Total PCBs (reported)	*<u>280</u>*	<50	<50

IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; NR = not reported; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; COPC = chemical of potential concern; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-ON, LS = Skin-on fillets, left side.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.10 Tissue chemistry data used to assess injury to human uses of fishery resources (channel catfish; *Ictalurus punctatus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station	**910262011**
Reference	IDEM 2000a
Geographic Area	GCR/IHC
Year	2000
Lab Tissue Type[1]	SK-OFF
Number Fish/Sample	1
Length (cm)	56
Weight (gm)	1673
Latitude	41.613055556
Longitude	-87.4325
Conventionals (%)	
Percent Lipid	19.5
Percent Moisture	60.6
Metals (mg/kg)	
Mercury	0.095
Pesticides (µg/kg)	
Aldrin	<2.5
Dieldrin	21
Aldrin + Dieldrin[2]	NC
2,4'-DDD	<5
4,4'-DDD	55
Sum DDD[2]	NC
2,4'-DDE	<5
4,4'-DDE	520
Sum DDE[2]	520

Table A5.10 Tissue chemistry data used to assess injury to human uses of fishery resources (channel catfish; *Ictalurus punctatus*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station	**910262011**
Pesticides (µg/kg; cont.)	
2,4'-DDT	<5
4,4'-DDT	15
Sum DDT[2]	NC
Total DDT[2]	520
Heptachlor	<2.5
Heptachlor epoxide	<2.5
Heptachlor + Heptachlor epoxide[2]	NC
Alpha (Cis) Chlordane	<2.5
Cis-Nonachlor	28
Gamma (Trans) Chlordane	12
Oxychlordane	9.4
Trans-Nonachlor	68
Total Chlordane (all isomers)[2]	96
Polychlorinated Biphenyls (µg/kg)	
Total PCBs (reported)	***<u>4600</u>***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; PCBs = polychlorinated biphenyls; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: SK-OFF = Skin off fillets.
[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.11 Tissue chemistry data used to assess injury to human uses of fishery resources (brown trout; *Salmo trutta*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**980431002** **210-96**	**980431003** **211-96**
Reference	IDEM 2000a	IDEM 2000a
Geographic Area	IH/LM	IH/LM
Year	1996	1996
Lab Tissue Type[1]	SK-ON, SC-OFF	SK-ON, SC-OFF
Number Fish/Sample	1	3
Length (cm)	37.2	43.5 - 47
Weight (gm)	710	950 - 1490
Latitude	41.670277778	41.670277778
Longitude	-87.43666667	-87.43666667
Conventionals (%)		
Percent Lipid	9.09	11.31
Percent Moisture	70	68
Metals (mg/kg)		
Mercury	<0.04	<0.04
Pesticides (µg/kg)		
Aldrin	<8	<8
Dieldrin	22	32
Aldrin + Dieldrin[2]	NC	NC
2,4'-DDD	<10	<10
4,4'-DDD	24	26
Sum DDD[2]	NC	NC
2,4'-DDE	<20	<20
4,4'-DDE	87	100
Sum DDE[2]	NC	NC

Table A5.11 Tissue chemistry data used to assess injury to human uses of fishery resources (brown trout; *Salmo trutta*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**980431002** **210-96**	**980431003** **211-96**
Pesticides (µg/kg; cont.)		
2,4'-DDT	<20	<20
4,4'-DDT	16	23
Sum DDT[2]	NC	NC
Total DDT[2]	NC	NC
Heptachlor	<16	<10
Heptachlor epoxide	<8	<8
Heptachlor + Heptachlor epoxide[2]	NC	NC
Alpha (Cis) Chlordane	8.7	<8
Cis-Nonachlor	10	19
Gamma (Trans) Chlordane	<8	<8
Oxychlordane	<8	<8
Trans-Nonachlor	<16	<16
Total Chlordane (all isomers)[2]	NC	NC
Polychlorinated Biphenyls (µg/kg)		
Total PCBs (reported)	*<u>1200</u>*	*<u>910</u>*

IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels.
USFDA = United States Food and Drug Administration; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: SK-ON, SC-OFF = Skin on fillets, scaleless.

[2]Calculated total (see Section 3.2 for a description of data treatment).

Table A5.12 Tissue chemistry data used to assess injury to human uses of fishery resources (gizzard shad; *Dorosoma cepedianum*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station Sample	Q-SHAD-1	Q-SHAD-7	R-SHAD-1	R-SHAD-2	R-SHAD-3	R-SHAD-4,5	R-SHAD-6,11	R-SHAD-12	R-SHAD-13,14	980431001 209-96
Reference	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	Risatti and Ross 1989	IDEM 2000a
Geographic Area	GCR/IHC	GCR/IHC	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM	IH/LM
Year	1988	1988	1988	1988	1988	1988	1988	1988	1988	1996
Lab Tissue Type[1]	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	WHOLE	SK-ON, SC-OFF
Number Fish/Sample	1	1	1	1	1	2	2	1	2	5
Length (cm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	41.6 - 44.6
Weight (gm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	910 - 1150
Latitude	41.645679	41.645679	41.667786	41.667786	41.667786	41.667786	41.667786	41.667786	41.667786	41.670277778
Longitude	-87.472031	-87.472031	-87.439423	-87.439423	-87.439423	-87.439423	-87.439423	-87.439423	-87.439423	-87.43666667
Conventionals (%)										
Percent Lipid	19.54	5.15	23.12	4.21	12.63	6.16	4.655	15.66	20.09	20.14
Percent Moisture	67.07	78.38	66.20	78.29	63.25	75.73	84.205	76.82	80.91	64.2
Metals (mg/kg)										
Mercury	0.0757	0.0414	0.0781	0.0346	0.0224	0.0311	<0.00714	NR	0.0380	<0.04
Pesticides (µg/kg)										
Aldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	<8
Dieldrin	NR	NR	NR	NR	NR	NR	NR	NR	NR	22
Aldrin + Dieldrin[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
2,4'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	<10
4,4'-DDD	NR	NR	NR	NR	NR	NR	NR	NR	NR	22
Sum DDD[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
2,4'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	<20
4,4'-DDE	NR	NR	NR	NR	NR	NR	NR	NR	NR	130

Table A5.12 Tissue chemistry data used to assess injury to human uses of fishery resources (gizzard shad; *Dorosoma cepedianum*); bolded values indicate an exceedance of the USFDA tolerance level or action level; italicized and underlined values indicate an exceedance of the ISDH Group 1 threshold.

Station **Sample**	**Q-SHAD-1**	**Q-SHAD-7**	**R-SHAD-1**	**R-SHAD-2**	**R-SHAD-3**	**R-SHAD-4,5**	**R-SHAD-6,11**	**R-SHAD-12**	**R-SHAD-13,14**	**980431001** **209-96**
Pesticides (µg/kg; cont.)										
Sum DDE[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
2,4'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	<20
4,4'-DDT	NR	NR	NR	NR	NR	NR	NR	NR	NR	16
Sum DDT[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
Total DDT[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
Heptachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	<8
Heptachlor epoxide	NR	NR	NR	NR	NR	NR	NR	NR	NR	<8
Heptachlor + Heptachlor epoxide[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
Alpha (Cis) Chlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	9.7
Cis-Nonachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	8.8
Gamma (Trans) Chlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	<8
Oxychlordane	NR	NR	NR	NR	NR	NR	NR	NR	NR	<8
Trans-Nonachlor	NR	NR	NR	NR	NR	NR	NR	NR	NR	<16
Total Chlordane (all isomers)[2]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NC
Polychlorinated Biphenyls (µg/kg)										
Total PCBs (reported)	*310*	*155*	*731*	*197*	*105*	*1200*	*669*	*86.7*	*88.7*	***2400***

GCR/IHC = Grand Calumet River and Indiana Harbor Canal; IH/LM = Indiana Harbor and nearshore areas of Lake Michigan; PCBs = polychlorinated biphenyls; USEPA = United States Environmental Protection Agency; COPC = chemical of potential concern; NR = not reported; USFDA = United States Food and Drug Administration; NC = not calculated; all values contributing to the total were less than detection limit data and low level detects, which were treated as zero in accordance with the guidance provided by USFDA (2001), to facilitate comparison with the action levels; ISDH = Indiana State Department of Health.

[1]Lab Tissue Type: WHOLE = Whole body (Note that the data reported in this appendix are calculated COPC concentrations in skin-on fillets using the USEPA-recommended conversion factors from the whole body data; USEPA 2000); SK-ON, SC-OFF = Skin-on fillets, scaleless.
[2]Calculated total (see Section 3.2 for a description of data treatment).